AIR CONDITIONING NUMBER.

JUL 19

THE HEATING AND VENTILATING MAGAZINE

Vol. XIII. No. 7.
$1.00 a year. 10 cents a copy

NEW YORK, JULY, 1916.

Publication Office:
1123 Broadway, New York

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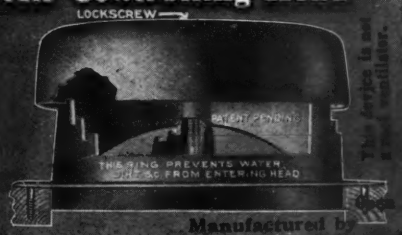

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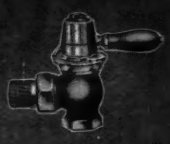

THE DOLE VALVE COMPANY

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THE CLARAGE BABBITTED BEARING, the only point of wear about the fan, requires the least attention and gives the best service of any fan bearing on the market. It is unusually large, holds a generous supply of oil, is double ring oiling, oil-tight, dust-proof and trouble-proof. It is adjustable on its seat and self-aligning, assuring a properly located and free running wheel. The bearings are supported by CAST IRON SIDE PLATES, which carry the weight of the wheel to the foundation, assuring lack of vibration and long life to the bearing.

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Write for Bulletin H-51

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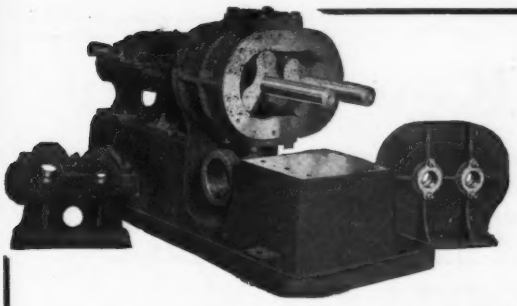

Don't Make This Mistake

If you have made the mistake of installing a cheap, unsuccessful Rotary Pump, do not make the further mistake of concluding that all rotary pumps are worthless.

Instances of this kind have occasionally come to our notice and the "victim" is hard to convince that he would have had different results with the

Connersville Valveless Rotary Pump

This high grade Pump has been used for Vacuum Heating since 1908 in modern hotel, office, store, factory and other buildings in every state and city.

Ask for Bulletin 12H.

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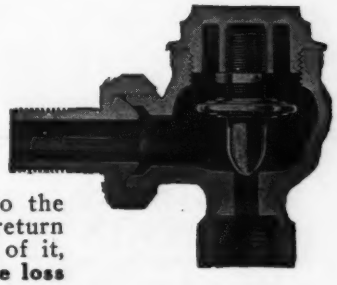
Freely Discharges Air and Water Without Loss of Steam



THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor and vacuum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, **to free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job. Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either concealed adjustment (as illustrated) or with outside adjustment. **Write for literature fully describing this trap**

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Dial to set at temperature desired.

Cold—60°
Cool—65°
Medium—70°
Warm—75°
Hot—80°

is the product of years of experience and the careful thought of experts. It is made of the best material, by the latest and best machinery, operated by expert machinists.

The design and construction have been improved until our present form has reached that state known as perfect.

That is why
JOHNSON SYSTEM
OF TEMPERATURE REGULATION
AND HUMIDITY CONTROL
is Standard

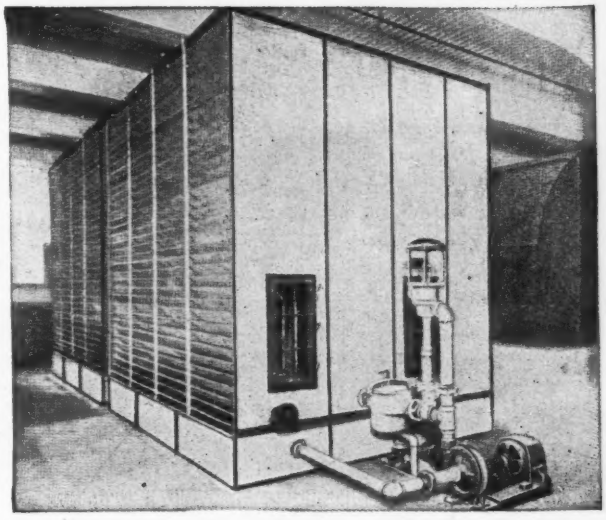
Johnson Service Co.

MILWAUKEE, WIS.

Engineers and Architects: Here's a Point Worth Remembering When You Want Cooperation on Air Conditioning Problems.

Very often **promptness** is a close second to efficiency, economy and guaranteed performance, when you are specifying air conditioning, ventilating, and drying equipment.

Take it from Ballinger & Perrot that you can depend upon us in this respect, for they have reason to **know** from many experiences with us.



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ARCHITECTS AND ENGINEERS
N.W. COR. 17TH AND ARCH STS.
PHILADELPHIA

"We wish to express our thanks for the efficient workmanship and admirable progress made in installing your ventilating apparatus in the Masonic Temple, Philadelphia, in time for use for the Grand Lodge meeting, September 1st.

"In view of the fact that you only received your contract for this work August 9th, the achievement is highly creditable to all concerned and is appreciated by Ballinger & Perrot."

Ballinger & Perrot

One or more clients each rated at over $1,000,000 and covering 50 different industries have used Carrier service and Carrier apparatus. And the men who helped to make these installations successful will advise you without charge.

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Engineering Corporation
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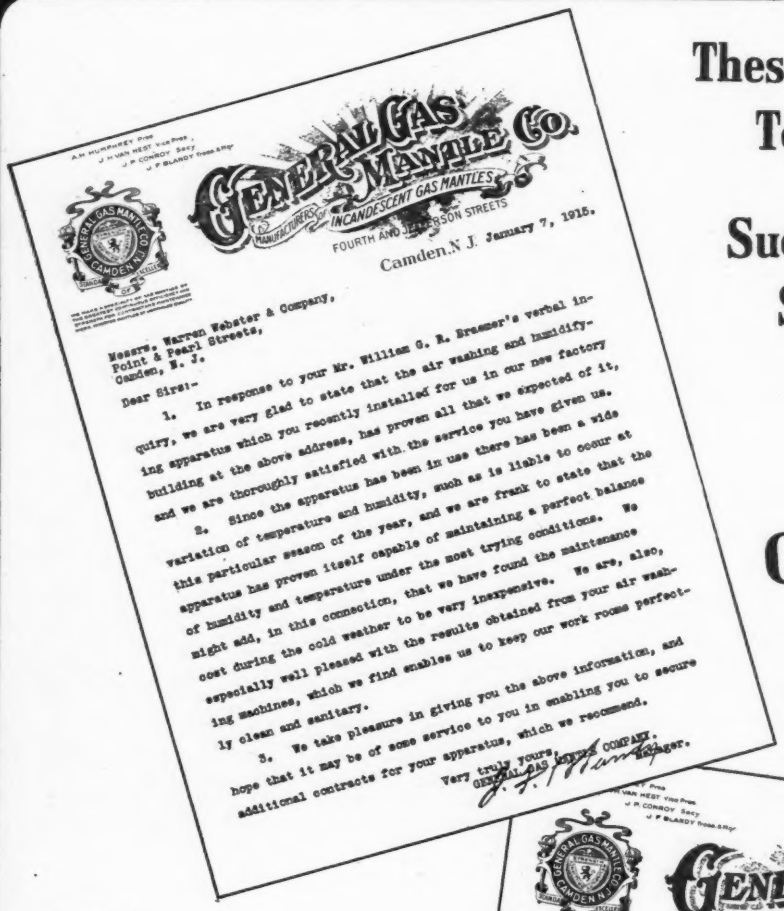
New York

Boston Philadelphia Buffalo
Chicago

These Two Letters Tell the Story of the Successful Results Secured by Webster Air Conditioning Apparatus



GENERAL GAS MANTLE CO.
MANUFACTURERS OF INCANDESCENT GAS MANTLES
FOURTH AND JEFFERSON STREETS

Camden, N. J. January 7, 1915.

Messrs. Warren Webster & Company,
Point & Pearl Streets,
Camden, N. J.

Dear Sirs:-

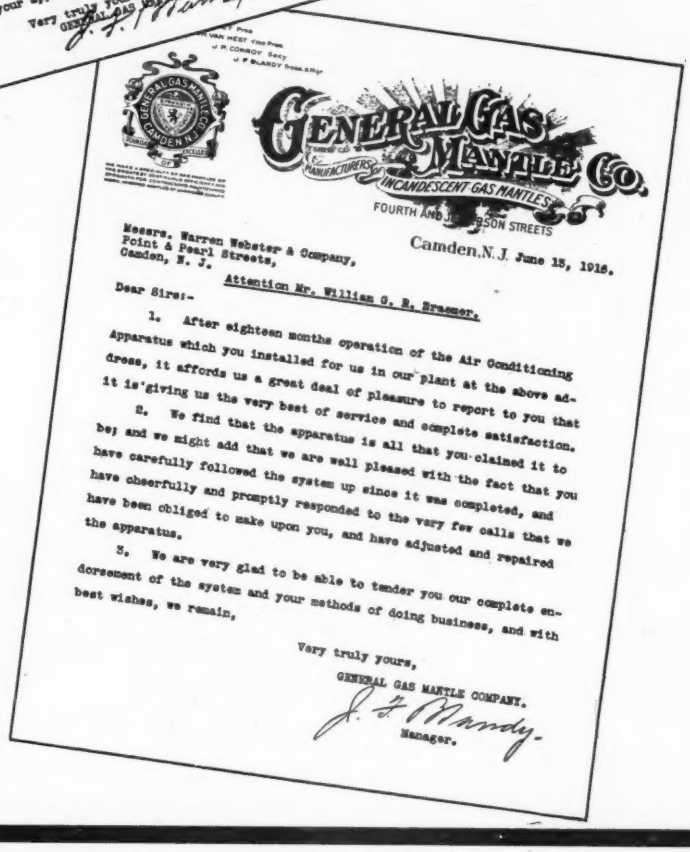
1. In response to your Mr. William G. R. Kramer's verbal inquiry, we are very glad to state that the air washing and humidifying apparatus which you recently installed for us in our new factory building at the above address, has proven all that we expected of it, and we are thoroughly satisfied with the service you have given us.

2. Since the apparatus has been in use there has been a wide variation of temperature and humidity, such as is liable to occur at this particular season of the year, and we are frank to state that the apparatus has proven itself capable of maintaining a perfect balance of humidity and temperature under the most trying conditions. We might add, in this connection, that we have found the maintenance cost during the cold weather to be very inexpensive. We are, also, especially well pleased with the results obtained from your air washing machines, which we find enables us to keep our work rooms perfectly clean and sanitary.

3. We take pleasure in giving you the above information, and hope that it may be of some service to you in enabling you to secure additional contracts for your apparatus, which we recommend.

Very truly yours,
GENERAL GAS MANTLE COMPANY.
J. F. Blandy
Manager.

THIS letter was received after the Webster Air Conditioning Equipment had been installed about 3 MONTHS



GENERAL GAS MANTLE CO.
MANUFACTURERS OF INCANDESCENT GAS MANTLES
FOURTH AND JEFFERSON STREETS

Camden, N. J. June 15, 1915.

Messrs. Warren Webster & Company,
Point & Pearl Streets,
Camden, N. J.

Attention Mr. William G. R. Kramer.

Dear Sirs:-

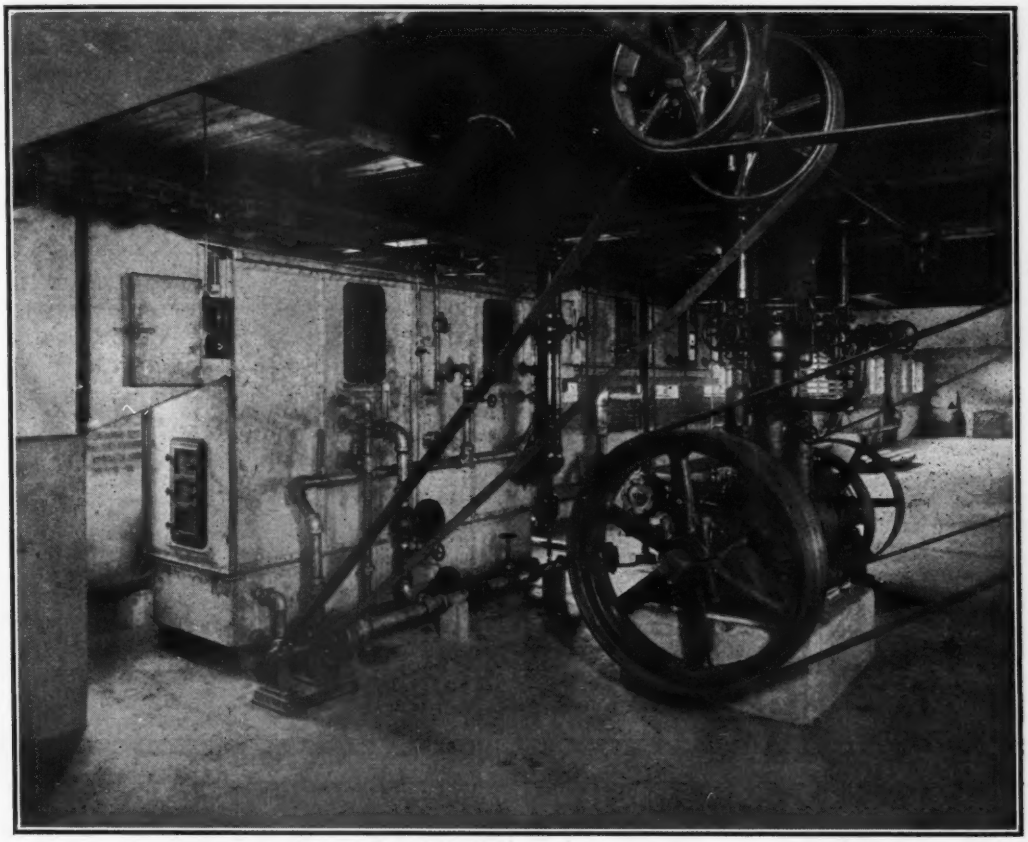
1. After eighteen months operation of the Air Conditioning Apparatus which you installed for us in our plant at the above address, it affords us a great deal of pleasure to report to you that it is giving us the very best of service and complete satisfaction.

2. We find that the apparatus is all that you claimed it to be; and we might add that we are well pleased with the fact that you have carefully followed the system up since it was completed, and have cheerfully and promptly responded to the very few calls that we have been obliged to make upon you, and have adjusted and repaired the apparatus.

3. We are very glad to be able to tender you our complete endorsement of the system and your methods of doing business, and with best wishes, we remain,

Very truly yours,
GENERAL GAS MANTLE COMPANY.
J. F. Blandy
Manager.

THIS letter was received after the Webster Air Conditioning Equipment had been in operation about 18 MONTHS



Installation of Webster Air Conditioning Equipment for maintaining a constant temperature and humidity the year round, at the General Gas Mantle Co., Camden, N. J.

Webster Air Conditioning Apparatus

OUR long experience with the many and varied Air Conditioning problems presented to us, our exceptional facilities to study them in our own laboratory specially fitted to produce exacting conditions, and our engineering ability, demonstrated by the great number of plants we have satisfactorily equipped, enable us to design and furnish the type of Air Conditioning Apparatus that will meet your requirements.

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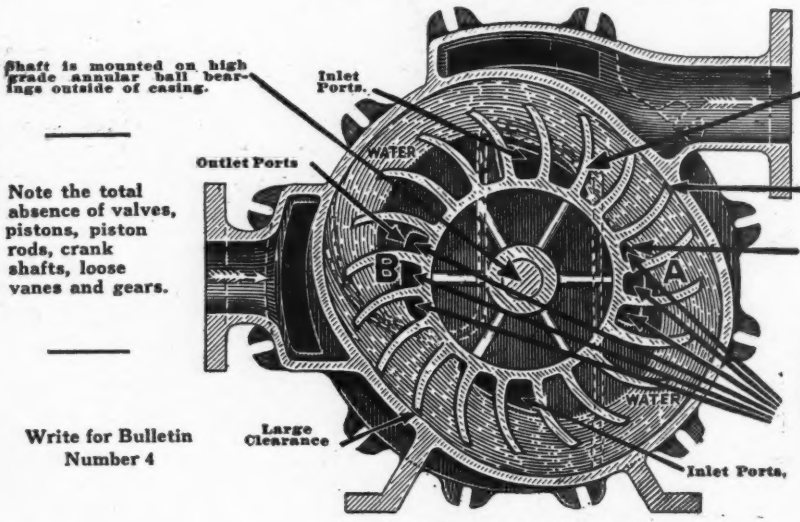
The Nash Hydro-Turbine



Note the total absence of valves, pistons, piston rods, crank shafts, loose vanes and gears.

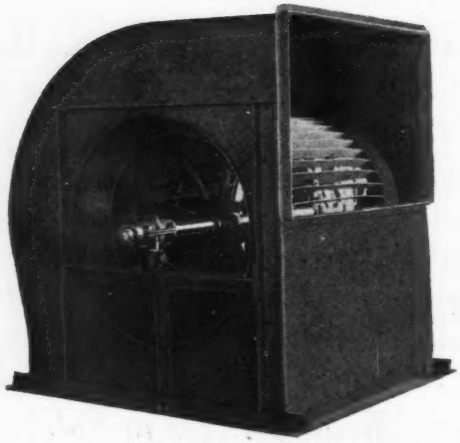
Side thrust is eliminated because compression takes place simultaneously on opposite sides of the rotor (at A and B).

Write for Bulletin Number 4

Note how the water acts as a piston

NASH ENGINEERING COMPANY, So. Norwalk, Conn.

Look At This Wheel!



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The Blades are set at an angle to the shaft.

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1st—Handles More Air

2nd—Requires Less Power than any Multivane Fan with blades set parallel with the shaft.

IT'S A

CYCLOIDAL MULTIVANE

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The Heating and Ventilating Magazine

VOL. XIII. No. 7.

Contents for July, 1916

Page

Air Conditioning in a Gas Mantle Plant 11
Equipment of the General Gas Mantle Co., Camden, N. J.

New Psychrometric Tables and Chart 17

Humidity and Automatic Control.....*H. L. Alt* 21
With Comparisons of Different Arrangements of Heaters and Reheaters and Their Effects.

Saturation Curves for Vapor, and Weight of Air.....*A. Bement* 27

The Early History of Air Conditioning 29

Washing and Cooling Air for Steam Turbine Generators..... 30

The Building of the Hospital.....*Oliver H. Bartine* 33
With Segregated Costs of the Construction of 22 Hospitals.

National Association of Master Steam and Hot Water Fitters..... 39
Proceedings of Twenty-Eighth Annual Convention.

American Society of Heating and Ventilating Engineers..... 45
Final Arrangements for Midsummer Meeting.
New Year Book.

Organization of Ohio Steam Heating Association 46

Sidewalk Ventilation Gratings on Broadway, New York, Barred..... 46

Correspondence 47
The Danger of Excessive Humidity in the Air Supply.
Cost of Removing and Replacing Pavements.

Important Extension of Central Station Steam Service in New York..... 48

Taking Cinders and Dust from the Gases in Chimneys..... 52

More Publicity for the Warm Air Furnace 53

Simple Directions for Measuring Humidity 54

The Business Outlook. VI. .....*Frank M. Huston* 54

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1123 Broadway, New York

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Represents the highest development in heating.

The DUNHAM VAPOR HEATING SYSTEM represents the highest quality to be found in any vapor system on the market. It sells for the most money because the devices furnished with the DUNHAM SYSTEM are complete and perform a real service in vapor heating, not found in imitating systems.

The DUNHAM VAPOR HEATING SYSTEM is both a heating system and a temperature regulating system. It appeals to the owner seeking a heating system which will add refinement to his home.

Send for Bulletin 11A describing the design and operation of this system

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BI-MULTI FANS

are used all over the country and abroad. They are specified by leading engineers and architects. Their design and construction permit operating these fans at the highest pressure without racking.

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We guarantee results. Write for Catalogue.

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are built exceptionally strong. They are guaranteed to stand up and do not rack under the heaviest work that fans are subjected to.

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Sink & Edwards, 519 Massachusetts Ave., Indianapolis, Ind.
J. M. Miller Sales Co., 2008 McKinney Ave., Dallas Texas
Eagle Roofing & Art Metal Works, 203 Cass St., Tampa, Fla.

THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JULY, 1916

Air Conditioning in a Gas Mantle Plant

Equipment of the General Gas Mantle Company, Camden, N. J.

Standardization of product and reduction of costs are among the chief efforts of every manufacturer, but the successful fruition of those efforts is frequently affected by an important, but too often neglected, factor. That factor is the all-pervading atmosphere, the well-known vagaries of which it is needless to dwell upon.

Considering its relativeely intangible nature is it not strange, perhaps, that it should be overlooked, yet it may be stated without fear of contradiction that every industry is adversely affected in some measure by the wide annual range of atmospheric characteristics.

The importance of temperature has always been taken into account and its annual range indoors artificially restricted to a large degree, but the more subtle element—humidity—has been allowed to rove in its natural wildness. The relations of temperature and humidity to the efficiency and well-being of man are quite generally recognized, but their effects upon materials, manufacturing processes and the uniformity, quality and quantity of production have been very generally overlooked, though it must be said that consideration is being given it now in a rapidly increasing measure.

PROBLEMS IN CONNECTION WITH MANUFACTURE OF GAS MANTLES.

It is of interest in connection with the foregoing remarks to consider the case of the General Gas Mantle Company of Camden, N. J.—manufacturers of incandescent gas mantles—who were pioneers in the realm of air conditioning as related to their particular industry, and to note briefly the considerations which moved them to investigate the feasibility and merits of controlling atmospheric conditions.

1. The output of the factory was greatly curtailed and at times stopped during hot weather, owing to the impossibility of keeping the women operators at work during such times — a rather superior grade of labor being employed in this plant.

2. At certain stages of the process, the contamination of the mantles by dust and dirt resulted in "pin holes" in the product, necessitating its rejection.

3. When certain atmospheric conditions prevailed—chiefly the combination of high temperature with high humidity —the uniformity, shape and quality of the mantles were seriously affected. The nature of the action was not understood, nor the limits within which trouble was experienced well defined, but it is noteworthy that the chief materials entering into the construction of mantles, namely, vegetable fibre and thorium salts, are extremely hygroscopic.

The absence of definite information in

relation to the third point precluded a proper analysis of the situation, so that it was finally decided to install equipment which would afford a wide range of temperature and humidity to admit of experimental determination, on a commercial scale, of the most favorable conditions for satisfactorily solving all the problems presented.

PRINCIPAL PROCESSES OF MANUFACTURE.

Briefly, the major processes in the manufacture of gas mantles are:

1. Knitting the tubular fabrics from cotton, or a mixture of cotton and ramie yarns.
2. Thoroughly washing and drying the fabrics.
3. Impregnating the fabrics with a solution containing the rare salts which give the mantle its incandescent properties.
4. Shaping and mounting the fabrics.
5. Burning out the organic elements of the fabric over gas flames, leaving the fragile ash skeleton.
6. Dipping the ash skeleton into an inflammable collodion and then drying; this permits handling and shipment of the mantle without danger of breaking, and this is the coating which must be burned off by the purchaser before the mantle is put in service.
7. Final mounting and packing.

The rooms in which processes No. 4 and No. 6 are carried out are supplied with conditioned air.

THE SHAPING ROOM.

The shaping room is in the second story of a three story building; the east and west wall are exposed, a considerable portion of the gross area being glass in metal frames. All walls, except the south, which is formed by a matched board partition, are 18 in. brick. The floor is of mill construction. About 60 operators do hand-work exclusively in this room, which is supplied with an air volume sufficient to maintain in summer a temperature as low as 75° F., with an outside temperature of 100° F.; at this room temperature a specified relative humidity is maintained. In winter also the same temperature and humidity can be maintained with 0° F., outside.

FAN, HEATER, AIR COMPRESSOR, DEW POINT THERMOSTAT AND TANK, PLANT OF GENERAL GAS MANTLE CO., CAMDEN, N. J.

Up to 80% of the maximum air volume delivered to the room may be recirculated, this being manually controlled during a part of the year and automatically regulated the balance of the time, as described hereinafter.

THE DIPPING AND DRYING ROOM.

Directly above the shaping room is the dipping and drying room, a tight enclosure, the ceiling and walls of which are made of asbestos board to render them fireproof. The floor is metal covered and there are no windows or exposed walls. The air supply is brought into the room from an opening in the ceiling of the shaping room. The air is distributed overhead, and vent outlets located in the floor connected to an exhauster in the basement remove it and discharge it outside, as the acetone absorbed from the collodion in the drying process make it unfit for recirculation.

UNIQUE AIR CONDITIONING EQUIPMENT INSTALLED.

The air conditioning equipment is unique, not in point of magnitude, but as an illustration of the high development which the art has attained.

The air is passed through two Webster special dehumidifiers in series, in the first of which cold well water is sprayed and in the second refrigerated water is used. The temperature and dew-point of the air leaving the second dehumidifier is thermostatically controlled. The air then passes through a reheater and is warmed as required to keep the shaping room at the proper temperature, a thermostat in the room automatically regulating this. From the reheater the air passes into the fan, thence to the rooms. All the air conditioning equipment is in the basement.

GENERAL VIEW OF AIR CONDITIONING PLANT, GENERAL GAS MANTLE CO., SHOWING DEHUMIDIFIERS, AMMONIA COMPRESSOR, CONDENSING COILS, ETC.

ARRANGEMENT OF FIRST DEHUMIDIFIER.

Both dehumidifiers are built of galvan-

ized American Ingot iron, braced with 1½-in. galvanized angles. The first dehumidifier is supported on a wooden platform suspended from the ceiling by iron rods, an arrangement which it will be seen from the photographs makes for accessibility and economy of space. The spray chamber casing is equipped with ample-sized glass-paneled doors, which, with a vapor-proof marine light within the spray chamber, renders access and inspection easy.

Well water at 52° to 54° F. is sprayed into the air through brass spiral mist nozzles, arranged in two equal headers, the water being discharged in the direction of air flow by those nearer the entrance to the spray chamber, the balance being opposed thereto. This water, after washing and cooling the air, falls into a pan 6 in. deep, extending under the entire apparatus, from which it drains through an open overflow and running trap to sewer. After passing through a low resistance eliminator in which all free moisture is removed, the air leaves this apparatus and passes into the second dehumidifier at a temperature of about 63° F., depending upon the outside weather conditions and the amount and condition of the air recirculated.

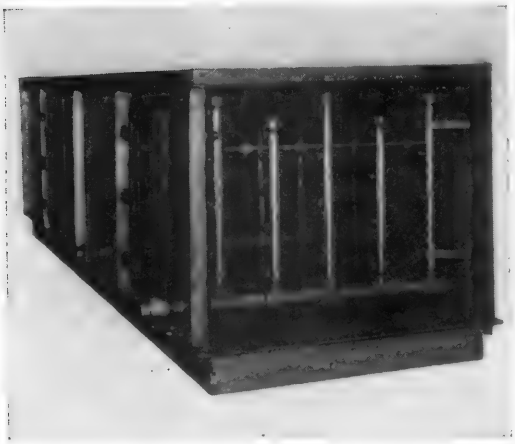
An artesian well was sunk especially to secure water for this apparatus and it is taken from the well by a power pump and delivered to a tank placed on the roof of the building, which maintains a steady pressure of 20 lbs. at the spray nozzles in the dehumidifier; this arrangement secures the coldest water at the dehumidifier where its maximum refrigerating effect is desired.

ARRANGEMENT OF SECOND DEHUMIDIFIER.

The second dehumidifier is a double compartment arrangement, supported on I-beams. The upper compartment forms the spray chamber, which is of the same shape and size as that of the well-water dehumidifier, and encloses the eliminator and two equal, opposed headers of mist nozzles. The lower compartment encloses a Baudelot coil for cooling the spray water and consists of 275 lin. ft. of 2-in. pipe arranged in six rows and six pipes high; it is fitted with slotted pipe water distributing troughs with leveling devices, expansion valves, supporting stands, etc. Both compartments are equipped with glass-paneled doors and the upper one with a marine light; the end plates of the lower compartment are removable, thus the whole apparatus is readily accessible.

Tanks 15 in. deep extend under both compartments and each is equipped with a ball float valve for admitting fresh water as required for filling and to keep the water line constant, a removable

FRESH AIR AND AIR RETURN DUCTS TO DEHUMIDIFIERS, PLANT OF GENERAL GAS MANTLE CO. (NOTE AUTOMATIC DAMPERS.)



FIRST DEHUMIDIFIER DESIGNED FOR USE WITH ARTESIAN WELL WATER.

double-box perforated brass strainer completely submerged for guarding the outlet to the pump, and a valved drain to sewer. The lower tank has an open overflow, while the upper tank has a valved overflow the level of which is about one inch lower than that of a series of hooded overflows connecting into the water distributing pipes in the lower compartment. The ball float valve is adjusted to maintain a water line level with the valved overflow, but when refrigeration is being used the valve in the overflow is closed and the water line stands level with the overflows to the distributing pipes, so that any excess of water coming into the system by reason of the condensation of moisture from the air is ultimately relieved through the overflow of the lower tank.

When refrigeration is not being used the valved overflow is kept open and thus no water escapes to the lower compartment.

A centrifugal pump maintains the proper pressure on the spray nozzles and is so connected to the dehumidifier that it can draw from either tank or both, as required, to keep the air at the proper dew-point.

REFRIGERATING EQUIPMENT.

Refrigeration is supplied by a Vilter 9 in. x 9 in. vertical single-acting ammonia compressor operating at about 99 r.p.m., having a maximum capacity of 12 tons at a head pressure of about 125 lbs., and a suction pressure of about 35 lbs. This is equipped with oil separator, double pipe counter-current condenser and ammonia receiver. The condenser is 12 pipes high, 21 ft. long, inner pipes 1¼ in., outer pipes 2 in. Water is supplied from the roof tank at the maximum rate of 15 gals. per minute. No speed regulation of the compressor is possible and it accommodates itself to the carrying requirements by decreasing the suction pressure as the work demanded drops, which obviously increases its capacity and power consumption.

EXHAUST STEAM USED TO HEAT AIR.

The main reheater consists of 3 rows of 40-in. regular pattern Vento radiation dipped in asphaltum, each row containing 5 sections on 5-in. centers. Each row has an independent supply valve and is dripped through a Webster water seal trap into the vacuum return. A single diaphragm valve regulates the supply of exhaust steam to the entire heater in accordance with the demands of the shaping room thermostat.

The fan is a No. 3 full-housed Niagara-Conoidal type and operates at 800 r.p.m., against 1-in. static pressure.

FRONT VIEW OF SECOND DEHUMIDIFIER.

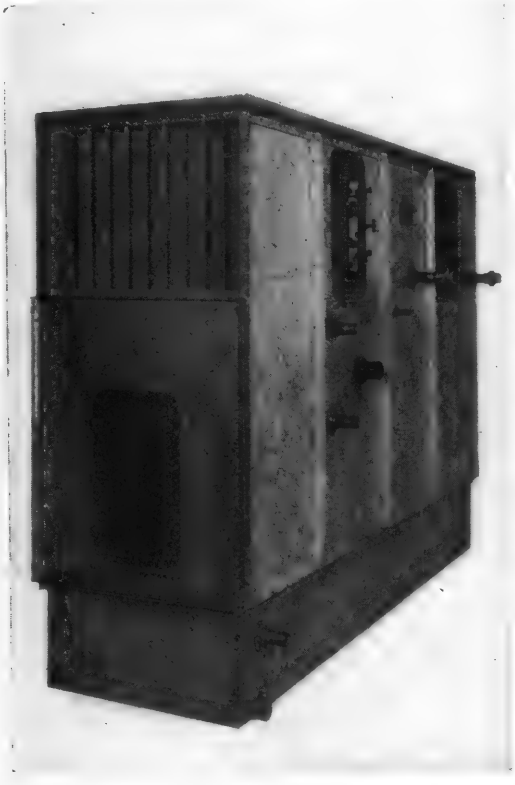
The ammonia compressor, dehumidifier pump and fans take power from a line shaft and countershafting driven by a Vim steam engine operating at 266 r.p.m., the exhaust being used in the reheater. The driving pulley for the compressor is of the clutch type.

The Johnson system of temperature regulation is used, compressed air being furnished by a hydraulic compressor; thermostats are of the graduated-acting type.

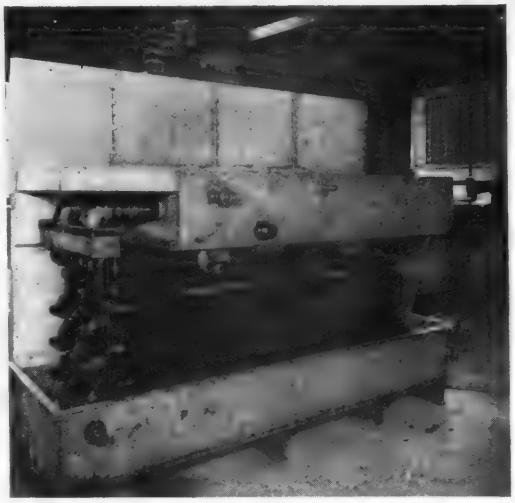
HOW THE SYSTEM IS OPERATED.

The system may be operated in one manner during the entire year, but in order to effect the economies possible some variation is necessary. Whenever the wet-bulb temperature outside exceds that in the shaping room the maximum amount of air is recirculated, sufficient fresh air being admitted through a by-pass damper to make up for that supplied the dipping room. Under these conditions both dehumidifiers must be used and well water and refrigeration expended.

The final dew-point of the air, which



REAR VIEW OF SECOND DEHUMIDIFIER.



INTERIOR OF SECOND DEHUMIDIFIER, SHOWING UPPER AND LOWER TANKS, BAUDELOT COILS, OVERFLOW AND WATER DISTRIBUTING ARRANGEMENT.

may be kept as low as 40° F., is maintained constant by a duct thermostat located at the air washer outlet which operates interacting- diaphragm valves in the suction lines from the upper and lower tanks of the second dehumidifier. Thus the proportions of cooled water from the latter and warmer water from the former are so regulated that the water issuing from the nozzles has the exact temperature necessary to cool the air to the proper degree. The valve in the line from the upper tank is "normally open" and the other "normally closed." A check valve in the latter line prevents a possible backflow of water from the upper to the lower tank.

When the outside wet-bulb temperature is at any point between the wet-bulb temperature of the shaping room and that of the well water, it is economical to take all air from outside, and still operate the dehumidifiers as for the previous condition.

When the outside wet-bulb temperature is at any point below the well water temperature the use of the first dehumidifer is discontinued, and all air taken from outside so long as the external wet-bulb does not fall below the dew-point temperature desired in the shaping room. The use of refrigeration is still required under these conditions.

When the outside wet-bulb falls below the dew-point temperature desired in the shaping room, the second dehumidifier

continues in service but the use of refrigeration is discontinued and the thermostat at the dehumidifier outlet, through valves and cross-connections in the air lines provided for the purpose, ceases to regulate the water volumes drawn by the pump from the upper and lower dehumidifier tanks, but is made to regulate interacting dampers in the fresh air intake and recirculating air duct, and the dehumidifier really becomes a humidifier, the water from upper tank being recirculated. By this arrangement the heat in the recirculated air is utilized in humidifying the fresh air taken in, consequently as it becomes increasingly colder outside, the amount of air recirculated automatically increases and the fresh air diminishes. This results in considerable economy of steam and at the same time makes unnecessary the use of a tempering coil.

The complete equipment was designed and furnished by Warren Webster & Company, Camden, N. J., and has been in operation for nearly two years, during which time it has given results which have vindicated the farsightedness of Mr. J. F Blandy, treasurer and general manager of the General Gas Mantle Co., through whose efforts the realization of the system was brought about. The difficulties previously experienced have completely disappeared and working conditions brought to a place of which any industry could be proud.

New Psychrometric Tables and Chart

In order to determine the amount of water vapor associated with air occupying a known volume, we must determine the saturation temperature and, from ordinary vapor tables (steam tables), obtain the vapor pressure.

The saturation point may be determined by reducing the temperature of a polished vessel and observing when moisture first forms on the surface. This temperature is commonly called "dew point." But such determinations require an experienced laboratory observer and cannot be conducted in the field.

It is for this reason, states a new handbook on "Psychrometric Tables for Cooling Tower Work," published by the Wheeler Condenser & Engineering Co., of Cartaret, N. J., that an indirect method of obtaining the dew point is used, namely, from suitable tables and from readings of the dry and wet bulb thermometers of a psychrometer,* which consists of two thermometers, suitably mounted, the bulb of one thermometer being covered by a close-fitting piece of muslin, which is well moistened in pure water, hence the term "wet bulb." There are two kinds of psychrometers, the stationary and sling. In the stationary psychrometer the two thermometers are suitably mounted and hung in a convenient place in the shade, and in a sling psychrometer they are whirled at a rate of about 200 R. P. M. by the observer. The sling psychrometer is the more accurate and these *tables are for use with sling psychrometer readings only.*

The wet bulb temperature must not be confused with the dew point, continues the handbook; it is from 0° to 20° higher. The dew point is the saturation temperature corresponding to the pressure of the vapor, while the wet bulb temperature is the temperature to which the evaporation of water from a wet cloth cools the mercury bulb of a thermometer when slung through the air. What happens is a heat interchange; the wet bulb temperature first dropping and then becoming finally fixed when the rate of heat absorption by convection from the air through which it passes equals the rate of cooling due to the evaporation of the moisture.

Simultaneous observations of dew point and wet and dry bulb thermometer readings have formed the basis for formulas and tables connecting the three temperatures.

The Weather Bureau of the United States Department of Agriculture has published authentic tables of this character by Prof. C. F. Marvin, based on the formula of Prof. Ferrel. A rational psychrometrical formula, connecting dew point and dry and wet bulb temperature readings, has also been the subject of investigation for many years, and recently

*Instruments of this kind may be obtained from thermometer and instrument manufacturers.

TYPICAL SECTION OF TABLE 1.

Reading of Thermometer Deg. F.		Dew Point	Humidity	Vapor in 1000 Cu. Ft. of Mixture	Reading of Thermometer Deg. F.		Dew Point	Humidity	Vapor in 1000 Cu. Ft. of Mixture
Dry	Wet	Deg. F.	%	Lbs.	Dry	Wet	Deg. F.	%	Lbs.
32	32	32	100	.304	36	35	33.7	91	.321
	31.5	30.7	95	.289		34	31.3	82	.289
	31	29.5	89	.271		33	28.6	73	.258
	30.5	28	84	.256		32	25.8	64	.226
	30	26.7	80	.243		31	21.8	55	.194
	29.5	25	74	.225					
	29	23.5	69	.210	37	37	37	100	.367
	28.5	21.7	65	.198		36	34.8	91	.334
	28	20	61	.186		35	32.4	82	.300
						34	29.8	75	.275
33	33	33	100	.316		33	26.9	66	.242
	32.5	31.8	95	.300		32	23.5	57	.209
	32	30.4	90	.284					
	31.5	29	84	.265	38	38	38	100	.381
	31	27.6	79	.250		37	35.8	92	.351
	30.5	26.2	75	.237		36	33.4	83	.316
	30	24.7	70	.221		35	30.8	74	.282
	29.5	22.8	65	.205		34	28.0	66	.251
	29	21.2	61	.193		33	25.0	59	.225
						32	21.3	50	.196
34	34.	34	100	.328					
	33.5	32.8	95	.312	39	39	39	100	.395
	33	31.6	90	.295		38	36.8	92	.364
	32.5	30.2	85	.279		37	34.4	84	.332
	32	28.7	80	.262		36	31.9	75	.296
	31.5	27.3	75	.246		35	29.2	67	.265
	31	25.7	70	.230		34	26.3	59	.233
	30.5	24.2	66	.216		33	23	52	.205
	30	22.5	61	.200					
	29.5	20.5	57	.187	40	40	40	100	.410
						39	37.8	92	.377
35	35	35	100	.340		38	35.6	84	.344
	34	32.7	90	.306		37	33	75	.308
	33	30.4	82	.279		36	30.5	68	.279
	32	27	71	.241		35	27.5	60	.246
	31	23.8	66	.225		34	24.4	53	.217
	30	20.6	55	.187		33	20.8	46	.189
36	36	36	100	.353	41	41	41	100	.425

an accurate formula has been deduced by W. H. Carrier, Transactions A. S. M. E., 1911 (published in THE HEATING AND VENTILATING MAGAZINE for March, 1912).

Once the dew point is known, the vapor pressure, the weight of moisture in a cubic foot, the relative humidity and the weight of the air in a cubic foot, etc., may all be obtained from steam tables and the fundamental law of gases.

The numerous tables, similar to those shown herewith, giving the dry and wet bulb temperatures, dew point, per cent., humidity and pounds of moisture per 1,000 cu. ft., were read from a large alignment chart prepared especially for the Wheeler Condenser & Engineering Company, by Prof. H. L. Parr, of Columbia University. The tables of properties of water vapor, by Marks and Davis, were used to obtain the vapor densities at different pressures. Acknowledgement is made to Mr. A. Gelhausen, of the Wheeler Company, for his painstaking care in tabulating the figures.

Prof. Parr's alignment chart is reproduced in Fig. 1 and gives the relation between dry bulb, wet bulb, dew point and per cent. humidity, any two being obtained from the other two. Readings can be made to within a small fraction of a degree. This chart agrees to within a very close percentage with the empirical formula, on which the U. S. Weather Bureau tables are based, and also very closely to the rational formula already referred to.

RANGE OF TABLES.

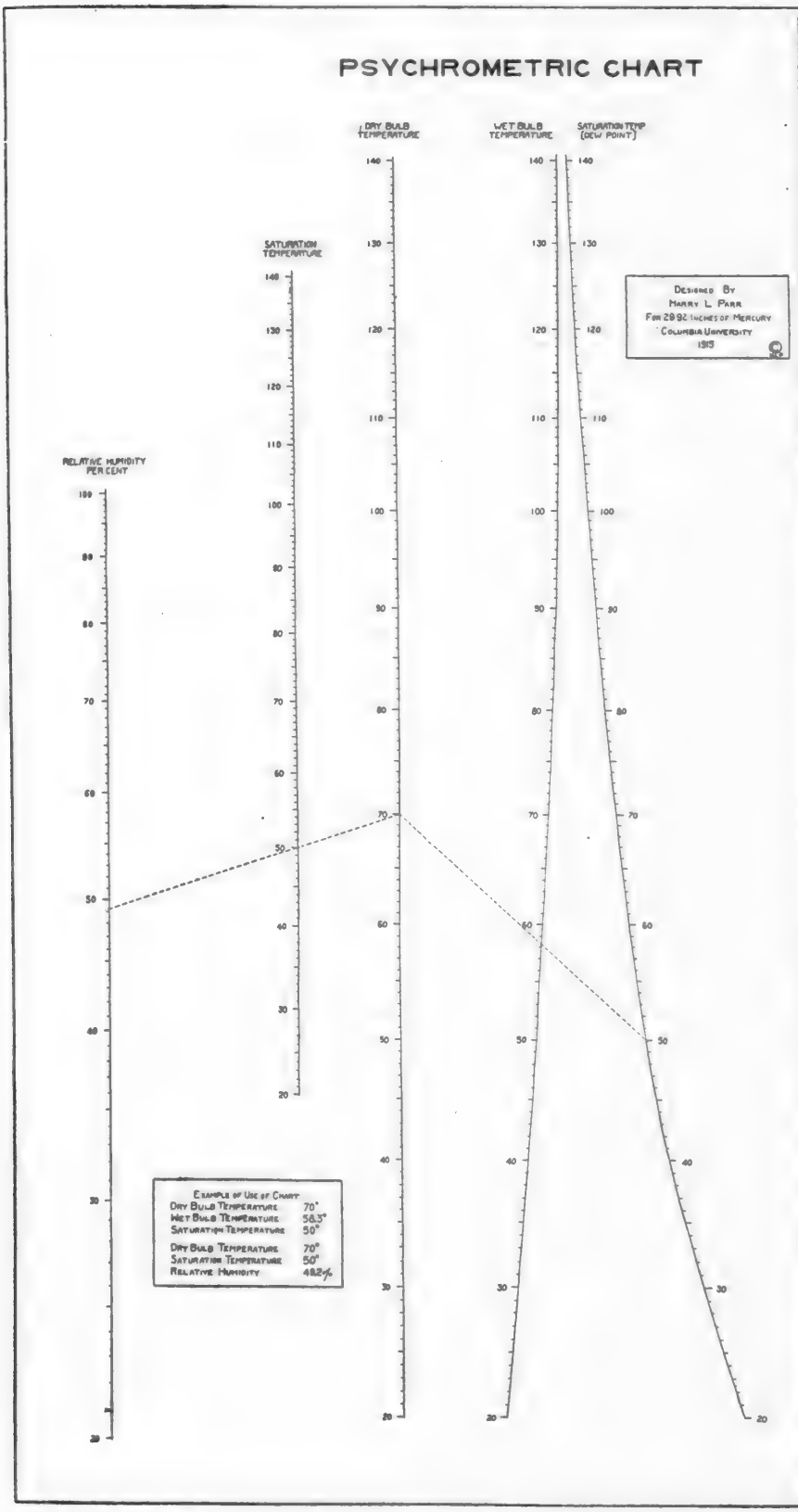
The range of dry bulb temperatures is from 32° to 140° F., and of wet bulb temperature, 28° to 140° F.

When the wet bulb temperature and dew point are below 32°, it is necessary for accuracy to know whether the vapor in the air was formed over ice, or "undercooled" water, since for the same temper-

TYPICAL SECTION OF TABLE 2.

Relation of Dew Point and Weight of Moisture per 100 Lbs. of Air. Barometer, 29.92 ins.

Dew Point Deg. F.	Lbs. Vapor Per 100 Lbs. Air Saturated	Dew Point Deg. F.	Lbs. Vapor Per 100 Lbs. Air Saturated	Dew Point Deg. F.	Lbs. Vapor Per 100 Lbs. Air Saturated	Dew Point Deg. F.	Lbs. Vapor Per 100 Lbs. Air Saturated
140	15.3058	110	5.9162	80	2.2102	50	.7623
139	14.8293	109	5.7363	79	2.1378	49	.7351
138	14.3615	108	5.5610	78	2.0670	48	.7088
137	13.9003	107	5.3785	77	2.0000	47	.6826
136	13.4703	106	5.2090	76	1.9329	46	.6565
135	13.0415	105	5.0455	75	1.8674	45	.6319
134	12.6327	104	4.8866	74	1.8041	44	.6086
133	12.2425	103	4.7329	73	1.7424	43	.5854
132	11.8575	102	4.5823	72	1.6836	42	.5623
131	11.4997	101	4.4369	71	1.6264	41	.5407
130	11.1457	100	4.2966	70	1.5706	40	.5204
129	10.7909	99	4.1597	69	1.5171	39	.5003
128	10.4557	98	4.0271	68	1.4651	38	.4814
127	10.1310	97	3.8990	67	1.4154	37	.4626
126	9.8161	96	3.7732	66	1.3667	36	.4459
125	9.5103	95	3.6519	65	1.3190	35	.4288
124	9.2135	94	3.5344	64	1.2738	34	.4090
123	8.9280	93	3.4207	63	1.2286	33	.3947
122	8.6515	92	3.3084	62	1.1849	32	.3785
121	8.3834	91	3.2015	61	1.1435	31	.3592
120	8.1235	90	3.0975	60	1.1028	30	.3424
119	7.8711	89	2.9958	59	1.0644	29	.3280
118	7.6263	88	2.8979	58	1.0267	28	.3134
117	7.3868	87	2.8015	57	.9898	27	.2982
116	7.1678	86	2.7096	56	.9544	26	.2852
115	6.9048	85	2.6192	55	.9205	25	.2723
114	6.7186	84	2.5333	54	.8866	24	.2594
113	6.5099	83	2.4482	53	.8542	23	.2478
112	6.3050	82	2.3663	52	.8226	22	.2358
111	6.1092	81	2.2868	51	.7917	21	.2249


PSYCHROMETRIC CHART
DRY BULB TEMPERATURE
WET BULB TEMPERATURE
SATURATION TEMP (DEW POINT)
SATURATION TEMPERATURE
RELATIVE HUMIDITY PER CENT
DESIGNED BY HARRY L. PARR FOR 29.92 INCHES OF MERCURY COLUMBIA UNIVERSITY 1913
EXAMPLE OF USE OF CHART
DRY BULB TEMPERATURE 70°
WET BULB TEMPERATURE 58.5°
SATURATION TEMPERATURE 50°
DRY BULB TEMPERATURE 70°
SATURATION TEMPERATURE 50°
RELATIVE HUMIDITY 48.2%

SATURATION TEMPERATURE DEGREES F	VAPOR PRESSURE INS MERCURY	LBS VAPOR PER CU FT SATURATED	CUBIC FEET PER LB VAPOR SATURATED	LBS VAPOR PER LB AIR SATURATED
140	5.88	0.00814	122.8	0.053038
139	5.77	0.00795	125.8	0.051793
138	5.58	0.00778	128.5	0.050613
137	5.43	0.00757	132.1	0.049005
136	5.28	0.00739	135.4	0.047903
135	5.16	0.00721	138.7	0.046815
134	5.02	0.00703	142.2	0.045727
133	4.88	0.00686	145.8	0.044645
132	4.76	0.00668	149.6	0.043575
131	4.64	0.00653	153.2	0.042687
130	4.52	0.00637	157.0	0.041457
129	4.390	0.006207	161.1	0.040509
128	4.282	0.006052	165.3	0.039557
127	4.168	0.005900	169.6	0.038570
126	4.057	0.005751	173.9	0.037610
125	3.948	0.005605	178.4	0.036703
124	3.841	0.005462	183.1	0.035755
123	3.737	0.005323	187.9	0.034850
122	3.635	0.005187	192.8	0.033915
121	3.535	0.005054	197.8	0.033034
120	3.438	0.004924	203.0	0.032135
119	3.344	0.004796	208.5	0.031211
118	3.252	0.004671	214.1	0.030263
117	3.161	0.004548	219.9	0.029368
116	3.073	0.004429	225.8	0.028478
115	2.987	0.004312	231.9	0.027644
114	2.904	0.004198	238.2	0.026784
113	2.822	0.004087	244.7	0.025999
112	2.740	0.003978	251.4	0.025058
111	2.665	0.003871	258.3	0.024086
110	2.589	0.003768	265.5	0.023163
109	2.515	0.003664	272.9	0.022308
108	2.443	0.003563	280.5	0.021510
107	2.372	0.003469	288.3	0.020785
106	2.303	0.003376	296.4	0.020090
105	2.236	0.003282	304.7	0.019437
104	2.171	0.003192	313.3	0.018846
103	2.107	0.003104	322.2	0.018269
102	2.045	0.003017	331.5	0.017723
101	1.985	0.002933	341.0	0.017203
100	1.926	0.002851	350.8	0.016720
99	1.869	0.002771	360.9	0.016257
98	1.813	0.002693	371.4	0.015821
97	1.759	0.002617	382.2	0.015390
96	1.706	0.002542	393.4	0.014973
95	1.655	0.002469	405.0	0.014568
94	1.605	0.002398	417.0	0.014178
93	1.556	0.002329	429.4	0.013801
92	1.508	0.002261	442.2	0.013436
91	1.462	0.002195	455.5	0.013085
90	1.417	0.002131	469.3	0.012745
89	1.373	0.002068	483.6	0.012418
88	1.331	0.002007	498.4	0.012103
87	1.289	0.001947	513.7	0.011801
86	1.248	0.001888	529.5	0.011509
85	1.209	0.001832	545.9	0.011232
84	1.171	0.001777	562.9	0.010966
83	1.134	0.001723	580.5	0.010711
82	1.098	0.001670	598.7	0.010463
81	1.063	0.001619	617.5	0.010224
80	1.028	0.001570	637.	0.009992
79	0.995	0.001523	657.	0.009770
78	0.964	0.001477	677.	0.009560
77	0.933	0.001433	698.	0.009359
76	0.903	0.001389	720.	0.009159
75	0.873	0.001346	743.	0.008974
74	0.845	0.001304	767.	0.008794
73	0.817	0.001263	792.	0.008624
72	0.790	0.001224	817.	0.008458
71	0.764	0.001186	843.	0.008294
70	0.738	0.001148	871.	0.008136
69	0.714	0.001112	899.	0.007983
68	0.690	0.001077	928.	0.007834
67	0.667	0.001043	958.	0.007694
66	0.644	0.001009	991.	0.007557
65	0.622	0.000977	1024.	0.007423
64	0.601	0.000946	1058.	0.007293
63	0.580	0.000915	1093.	0.007168
62	0.560	0.000885	1130.	0.007049
61	0.541	0.000856	1168.	0.006934
60	0.522	0.000828	1208.	0.006822
59	0.5034	0.000801	1249.	0.006714
58	0.4856	0.000775	1291.	0.006610
57	0.4684	0.000749	1335.	0.006508
56	0.4518	0.000724	1381.	0.006409
55	0.4357	0.000700	1430.	0.006315
54	0.4201	0.000676	1480.	0.006222
53	0.4049	0.000653	1532.	0.006132
52	0.3903	0.000631	1586.	0.006046
51	0.3762	0.000608	1643.	0.005962
50	0.3625	0.000587	1702.	0.005882
49	0.3492	0.000567	1763.	0.005804
48	0.3363	0.000548	1826.	0.005730
47	0.3238	0.000529	1892.	0.005658
46	0.3118	0.000510	1961.	0.005589
45	0.3002	0.000492	2033.	0.005519
44	0.2889	0.000475	2107.	0.005454
43	0.2782	0.000458	2185.	0.005392
42	0.2677	0.000441	2266.	0.005328
41	0.2575	0.000425	2350.	0.005267
40	0.2477	0.000410	2438.	0.005209
39	0.2382	0.000395	2530.	0.005153
38	0.2290	0.000381	2626.	0.005099
37	0.2202	0.000367	2725.	0.005046
36	0.2117	0.000353	2829.	0.004995
35	0.2034	0.000340	2938.	0.004946
34	0.1955	0.000328	3052.	0.004898
33	0.1878	0.000316	3170.	0.004847
32	0.1804	0.000304	3294.	0.004798
31	0.1720	0.000293	3466.	0.004752
30	0.1643	0.000276	3623.	0.004624
29	0.1565	0.000265	3774.	0.004498
28	0.1495	0.000253	3953.	0.004376
27	0.1426	0.000242	4132.	0.004262
26	0.1362	0.000232	4310.	0.004152
25	0.1298	0.000222	4504.	0.004045
24	0.1239	0.000212	4717.	0.003944
23	0.1182	0.000203	4926.	0.003847
22	0.1127	0.000194	5155.	0.003754
21	0.1076	0.000185	5405.	0.003664
20	0.1026	0.000177	5647.	0.003574

NEW PSYCHROMETRIC CHART, WITH TABLE, FOR QUICK FIGURING.
(Designed by Harry L. Parr, Columbia Univer sity, New York.)

ature the former vapor has a lower pressure. These tables refer to water vapor throughout, including the lines with dew points below 32°, where the maximum difference is one degree, as compared to vapor office. At lower dew points the difference would be greater. For very low temperatures the reader is referred to the United States Weather Bureau tables based on careful experiments of vapor pressure over ice.

In making winter observations with the sling psychrometer, it is pointed out that care must be taken that the wet bulb, if still moist, does not suddenly freeze and liberate heat. If it does, the whirling must be repeated until a *minimum stable* temperature is reached.

HUMIDITY.

The absolute humidity, of course, is the amount of moisture, often expressed in grains, in a cubic foot of space, also occupied by air. In these tables the moisture is given in pounds per 1,000 cu. ft. as a more practical engineering unit. The relative humidity is here expressed as the ratio of the absolute humidity to the absolute humidity if the water vapor were saturated at the observed dry bulb temperature. Thus the air temperature might be 79° F. and the dew point, 65° F. The pressure corresponding to 65° is 0.622 in. and the pounds per 1,000 cu. ft. (see Marks and Davis steam tables) is 0.977. As the superheat is 14°, the volume is increased so that the pounds per 1,000 cu. ft. at 79° =

$$0.977 \times \frac{460+65}{460+79} = 0.950.$$

If saturated at 70° F. the vapor pressure would be 0.996 in. and the density 1.523. The ratio 0.950 ÷ 1.523 =62.5% is the relative humidity.

WEIGHT OF 1,000 CU. FT. OF AIR.

An approximate basis for calculations involving the movement of air is 13 cu. ft. per pound.

To be accurate we must take into account the temperature of the air, and the partial pressure of the air which depends on the barometric pressure and the partial vapor pressure.

Vapor pressures are not given in these tables, but may be readily obtained by looking up the pressures corresponding to the dew point in a book of steam tables.

A convenient formula for the weight of 1,000 cubic feet of air is

$$W = 1330 \frac{B-V}{T}$$

Where W = weight of 1,000 cu. ft.

B = barometric pressure in inches of mercury (mercury corrected to physical standard of 32°).

V = vapor pressure corresponding to dew point in inches of mercury.

T = Absolute temperature = 460 + Fahr.

This formula is based on the experimental determinations of Rayleigh and Leduc.

Example:

Barometric pressure 29.5 in.

Dew point from dry and wet bulb readings, 60° F.

Air temperature, 70° (dry bulb).

The vapor pressure corresponding to 60° is 0.522 in., therefore:

$$W = 1330 \times \frac{29.5-0.522}{530}$$

$$= 1330 \times \frac{28.978}{530}$$

$$= 72.6 \text{ lbs.}$$

WEIGHT OF 1,000 CU. FT. OF MIXTURE.

This is the sum of the weights of 1,000 cu. ft. of air and the vapor in 1,000 cu. ft. under the existing humidity.

For the foregoing conditions the tables give the pounds of moisture per 1,000 cu. ft. as 0.81 and the total weight is 0.81 + 72.6 = 73.41 lbs.

MOISTURE PER 100 LBS. OF AIR.

While the absolute humidity is always expressed in grains per cubic foot, or, as in these tables, pounds per 1,000 cu. ft., it may be expressed as the weight of moisture associated with a given *weight of air,* assuming a fixed barometric pressure. The assumed atmospheric pressure and the given conditions of temperature and dew point determine the volume occupied by the air, while the dew point determines the moisture in each cubic foot. Table II. gives the pounds of vapor associated with 100 lbs. of air satu-

rated for dew points from 140° to 21°, and a barometric pressure of 29.92 in. of mercury.

The moisture per 100 lbs. of air is the same for the same dew point temperature and barometric pressure, irrespective of variation in dry and wet bulb thermometer readings. Thus, from Table I the dew point for 89° dry and 65° wet bulb is 50° and for 72° dry and 59° wet bulb it is also 50°, and the moisture per 100 lbs. of air from Table II for 29.92 barometer is the same in both cases and equal to 0.7623 lbs.

Humidity and Automatic Control

With Comparisons of Different Arrangements of Heaters and Reheaters and Their Effects.

BY HAROLD L. ALT

The modern air washer has introduced a new element in the hot blast heating and ventilating system which requires, not only that automatic control must be thoroughly understood, but that the requirements of the air washer must also be realized and properly met. As the air washer will vary, the humidity attained by the air in its final condition in the room, a thorough knowledge of the basic principles of humidity is necessary and, since the humidity is controlled by the temperature of the washing water, it is necessary to again revert to automatic temperature control in the washer to properly humidify the air.

BASIC DATA ON HUMIDITY.

It is a fairly well known fact that air at zero—which is the usual starting point for most heating and ventilating calculations—contains very little moisture, this amount being a maximum of roughly 1/14000 lb. of water per cubic foot. With this amount of moisture vaporized per cubic foot the air is saturated and will begin to precipitate the moisture, if the temperature is lowered or increased.

The vapor carrying capacity is greatly increased with a rise in temperature, so that a cubic foot of air at 32°, or freezing point, will carry 2/7000 lb. of water before it will start to precipitate. This is illustrated graphically in Figs. 1 and 2, Fig. 1 showing the quantity of water (black) in a cubic foot of air when compared to the amount (Fig. 2) contained at 32°.

A further increase in temperature continues the process, so that at 70° the amount of water per cubic foot can be raised as high as 8/7000 lbs. and at 100° it reaches about 19/7000, these increases being shown graphically (in black) in Figs. 3 and 4.

Normally, outside air varies in humidity within certain limits, usually between 35% and 75% of its total carrying capacity at the temperature of the air in question. A humidity of over 75% produces an excessively close feeling, which is very uncomfortable, and a humidity of less than 35% results in an atmosphere which is entirely too dry.

The average humidity is usually assumed at about 50% or 60% and is commonly termed "relative" humidity, it being a percentage relative to the total vapor carrying capacity of the air at the temperature in question, the total capacity being reached at the dew point, termed "absolute" humidity, and expressed in grains per cubic foot. Therefore, every temperature between zero and 100° F. has an *absolute* humidity graduated between ½ and 19 grains, the limits shown in Figs. 1 to 4, and the relative humidity

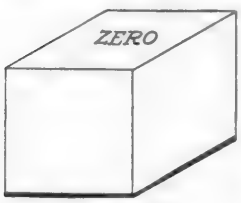


FIG. 1.

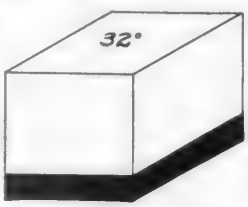


FIG. 2.

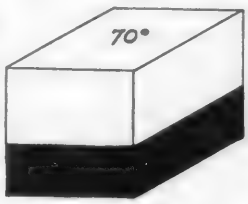


FIG. 3.

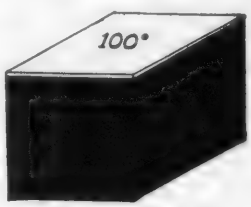


FIG. 4.

also graduates as it is a purely mathematical percentage of the absolute humidity.

The amount of moisture in air is usually computed in grains of water per cubic foot of air and is much easier to calculate in this way. There being 7,000 grains in a pound, the absolute humidity of air at 0° equals about ½ grain;

At 32° equals about 2 grains;
At 70° equals about 8 grains;
At 100° equals about 19 grains.

HOW TO OBTAIN ANY DESIRED PERCENTAGE OF HUMIDITY.

It can be readily understood from this short discussion of humidity that it is possible to obtain any desired percentage of humidity in air at 70° by saturating the air at a temperature where the total quantity of water just equals the total quantity required at the desired percentage when raised to 70°.

For example: Suppose it were desired to have 70° air with 25% relative humidity.

Absolute humidity at 70° dew point equals 8 grains.

25% of this equals 2 grains.

Now as 2 grains is just the amount of moisture in the air when *saturated* at 32°, if the air is saturated at 32° by means of an air washer spray it will contain 2 grains of water per cubic foot, and, when heated up to 70° by a heater, will have the desired 25% relative humidity.

It has been found by experience that about 60% relative humidity is the most satisfactory percentage for indoor work, which at 70° room temperature means 8×0.60, or 4.8 grains per cubic foot. As 4.8 grains per cubic foot is the same amount of water as will give saturated air at about 55°, this at once determines the temperature at which the air must leave the air washer.

Where humidity considerations enter the field, the problem resolves itself into raising the air from the outside temperature (usually zero) at the intake to about 55° where it leaves the air washer, and then the raising to the desired temperature for heating (usually 120°) or for ventilating only (usually 70°).

RELATIVE HUMIDITY MUST BE BASED ON FINAL ROOM TEMPERATURE.

Regardless of the transmitting temperature (whether 70°, 120° or any point between the two), the relative humidity must be based on the room temperature (usually 70°) as the air falls back to the room temperature after entering the room.

In spite of the fact that some manufacturers claim that tempering heaters are not necessary between the intake and the air washer, it is not the common practice to so install this apparatus, and, for the purposes of this article, it is necessary that the most common and accepted arrangements be considered in order to make the application of the diagrams as general as possible.

THREE METHODS OF CONTROLLING STACKS OF TEMPERING HEATER.

Probably the most common arrangement of heaters and washer is shown in Fig. 5, where a tempering heater of two rows is placed before the washer and a re-heater of two rows follows: The fan may be assumed as being interposed either between the air washer and the first row of the re-heater (Space D), or between the first and second row of the re-heater (Space E). The position of the fan has little effect on the method of controlling the tempering heater, but may affect the re-heater control to some extent.

It is generally agreed that the most ideal form of temperature control is that which results in the minimum amount of opening and closing of the valves in the pipes to the heater, at the same time maintaining fairly constant temperature at some given point beyond the heater. With this in mind the three methods of controlling the stacks of the tempering heater (shown in Figs. 5, 6 and 7) can be readily compared.

It is assumed in these three diagrams that the velocity of the air through the tempering heater and the surface therein is just sufficient to raise the air 20° in passing through each row. While this 20° rise would fall off slightly as the outside temperature increases, this is neglected in all three cases, as it has no practical bearing on the points desired to bring out.

DESCRIPTION OF FIRST METHOD OF CONTROL.

The inclined lines shown on Fig. 5 indicate by their rise or fall the changes of the air temperature during the progress

through the apparatus, starting at various outside temperatures from zero to 60°. The location of the control thermostats is shown by T enclosed within a circle and the height of the T vertically indicates the temperature at which the heater closes off.

From this it can be seen that in Fig. 5 the first stack is controlled by a thermostat located between the second heater and the air washer (in Space C) and set

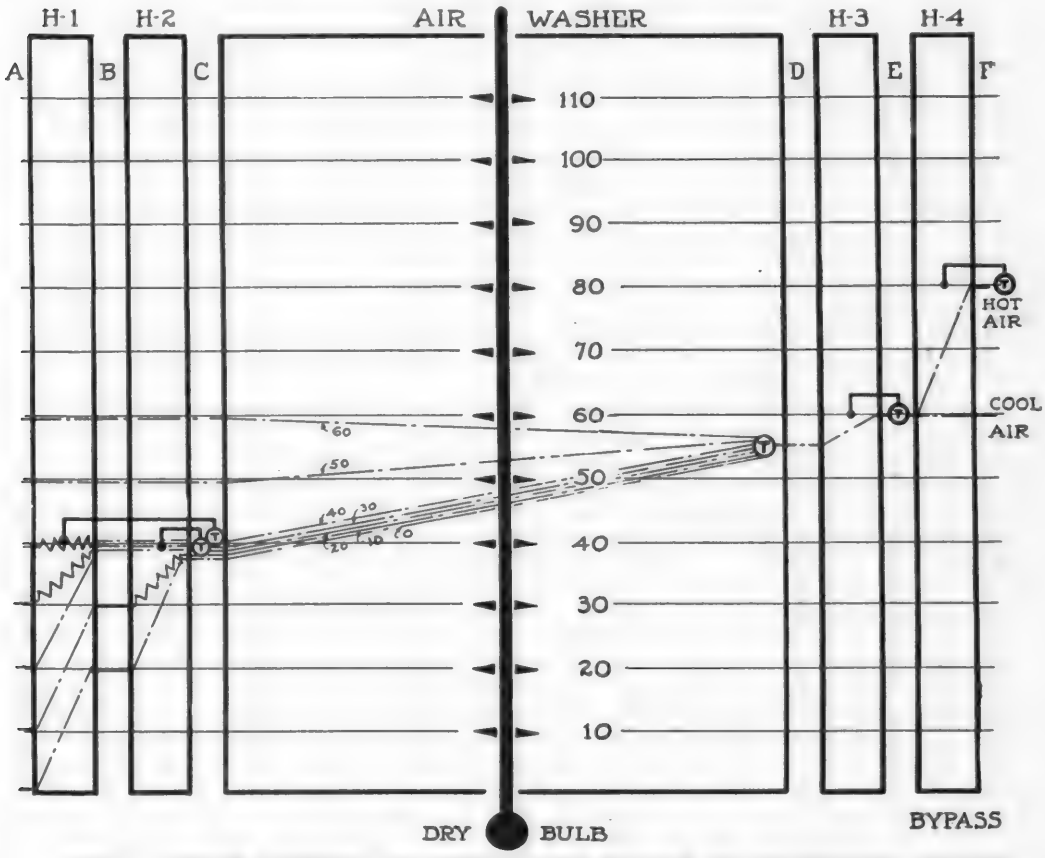


FIG. 5.—FIRST METHOD OF CONTROLLING STACKS OF TEMPERING HEATER.

for about 40°. The second row is controlled by another thermostat similarly located and set for 42°. This would seem to be an ideal control, as the temperature of the air entering the air washer is held between 40° and 42° all the time until the outside temperature rises above that figure.

A great mistake is often made in ventilation systems by basing their design solely for zero conditions, without a thought as to average winter weather, which runs from 20° to 40° outside temperature. If the temperature line for air entering at zero is followed across the first stack it is found that the air is raised to 20° F. The line then crosses horizontally to the second row, where it again rises 20°, or to 40°—right on the boundary where the second stack will begin to oscillate between the "off and on"—"off and on," condition.

Any increase above zero will result in a sufficient rise of the air temperature to immediately start the stack fluctuating, this continuing until an outside temperature of about 21° is reached, producing 41° at the thermostats, at which time the second row will go off completely and the increase of a single degree will start the first row oscillating.

This is graphically shown by the temperature line for air entering at 10°, rising to 30°, then rising in a zig-zag line across the second row, where it is increased only to 40°, on account of the retarding effect of the thermostat on the

second row; the zig-zag indicates that the temperature rise is not the full capacity of the heater and the heater, therefore, must be fluctuating.

Air entering at 20° rises to 40° in passing through the first stack and thereby shuts off the second. Air entering at 30° zig-zags across the first row, reaching 42°, and then passes through the second row without any farther change. Air at 42° shuts off all tempering heat and enters the air washer unchanged. Air at 50° is raised in passing through the air washer to 55°, but 60° air is cooled by evaporation to 55°.

The effect of such control can be summarized briefly by

(a) Variation of air temperature entering air washer 60° maximum, 40° minimum or 20 *degrees.*

(b) Oscillation of one heater or the other from zero temperature to 42° maximum or 42° *minimum range.*

SECOND METHOD OF CONTROL.

Compare this with the control shown in Fig. 6, where the first tempering coil is controlled by a thermostat in the cold air intake (Space A), set for 35°, and the second row is controlled by another thermostat set for 55°, and located between the tempering heaters and the air washer (Space C).

Zero air then rises to 20° in the first row, to 40° in the second, and to 55° in the air washer. No fluctuation is experienced at this temperature, nor indeed at 10° entering temperature and it is not until 15° air is reached that fluctuation of the second row is encountered. This continues until 35° outside air is reached, at which time the outside stack goes off and the second row continues to wobble until 55° is reached when the second row also goes off entirely.

Conditions for this method of control show:

(a) Variation of air temperature entering air washer 60° maximum, 40° minimum or 20°.

(b) Oscillation of one heater from 15° to 55° or 40° *total range.*

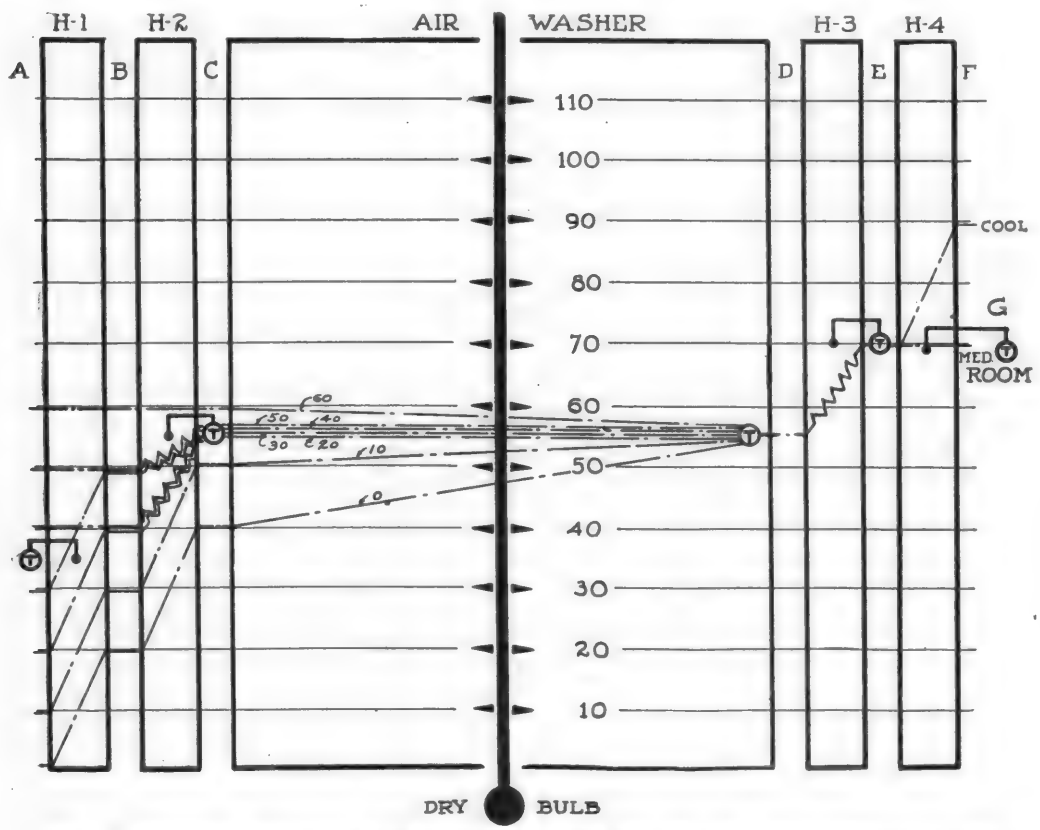


FIG. 6.—SECOND METHOD OF CONTROLLING STACKS OF TEMPERING HEATER.

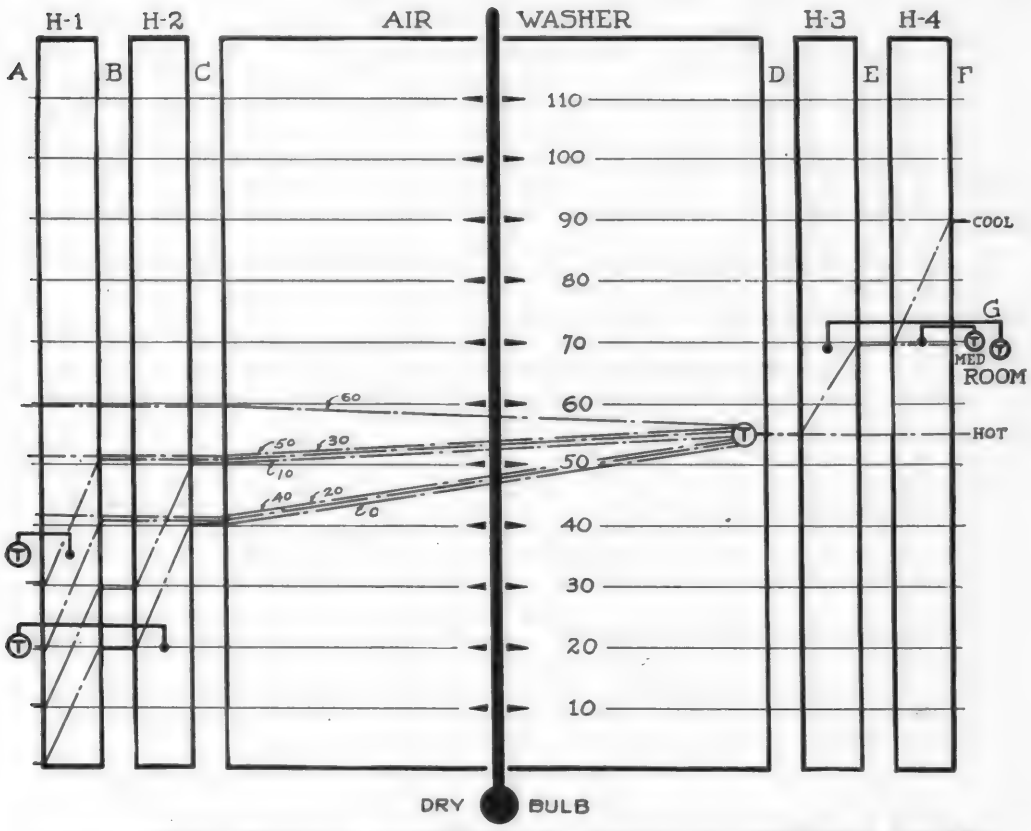


FIG. 7.—THIRD METHOD OF CONTROLLING STACKS OF TEMPERING HEATER.

This shows little improvement in any way over Fig. 5.

THIRD METHOD OF CONTROL.

In Fig. 7 the tempering heater has both stacks controlled from thermostats located in the cold air intake (Space A), one thermostat on the first row being set to throw on the stack at 35° or below and the other thermostat being set to throw on the second row at 20° or below.

Following the temperature lines of air entering at zero, it is seen that it rises to 20° in the first row and to 40° in the second, being raised from 40° to 55° by the air washer. At 10° above the air is heated to 50° by the heaters and the remaining 5° in the air washer.

At 19° above the air is raised to 59° and then cooled in the air washer to 55°, but at 20° the second row shuts off and the air enters the air washer at 40°. At 30° the second row is off and the air is raised to 50° by the first row, the remaining 5° being cared for in the washer. At 40° the tempering heater has been closed off entirely (this occurring at 35°), and the air enters the washer at 40°, being raised 15° more in the washer.

The net results of this arrangement are as follows:

(a) Variation of air temperature entering air washer—maximum, 60°—minimum, 40° equals 20°.

(b) Fluctuation—*None.*

This shows that the control of all tempering stacks from the cold air chamber not only does away with their wobbling, but also does this at practically no increased variation in air temperature at the entrance to the washer over that encountered by other schemes of control.

TREATMENT OF THE AIR AS IT LEAVES THE AIR WASHER.

On the outlet end of the air washer, with a saturated temperature of 55°, a vastly different condition results; whereas before the air entered at widely varying temperatures all of which it was desired to raise to as nearly 55° as possible, it is now required to vary the air temperature constantly at 55° to another temperature

suitable for the requirements in the room or rooms supplied by the system.

Suppose a double duct system is in use, or an individual duct system where air is taken from hot and cool air chambers so as to produce the desired duct temperature by means of automatic mixing dampers.

In order to make such a system a success thermostatic control of the mixing dampers from the room must be had. Also, if a room is overheated, it is not allowable to blow cold air at 55° into it—this air being, by the way, saturated as well. This condition is usually taken care of by automatic control of the mixing dampers, in the duct or at the base of the flue, by a thermostat located in the room.

In order to make sure that no air at 55° gets to the rooms it is customary to place the heater H3 (Fig. 5) next to the air washer and to insert the fan in space E, the discharge from the fan blowing both through and under the heater H4 by means of the bypass below into the cool air chamber.

Since the air in the cool air chamber should be 60° to avoid cold drafts in the room, and as this air bypasses H4, it follows that the heater H3 must raise the air from the final air washer temperature to 60°. In the case under consideration this means only a rise of 5°, involving a narrow heater and very high velocities In fact friction consideration alone would recommend decreasing the saturated temperature of the air washer to 50° and then raising the air 10° in heater H3 even at the sacrifice of a little humidity in the room later.

There seems to be no logical reason for automatic control on the heater H3, unless the system supplies air in varying quantities from time to time, as the quantity of air, velocity, entering temperature and desired rise are all constants for a given system. There is absolutely no reason why H3 cannot be designed for the 5° or, better, the 10° rise and then be allowed to run full open all the time, if the equipment is operated as intended.

COMPLICATIONS TO PROVIDE AGAINST.

Of course, stoppage of the air washer, or a change in air quantity would produce complications so that in general practice the thermostat is used set for 60° in the fan space E, while the heater H3 should be designed to raise the largest amount of air handled from the lowest temperature at which it enters the washer (40°) to the desired 60°. This will allow the discontinuation of humidifying, the closing down of the washer, or a change in air quantity, all without loss of the desired temperature; the heater, however, will wobble constantly, never being full on or off under normal conditions.

The quantity of air passing through the heater H4 is never constant and while the entire amount may go through on a cold morning when the building is just getting warmed up, along in the middle of the day it may all be bypassed. There seems to be no reason for trying to control the heater H4 automatically, as the temperature of air in the room outlets is controlled from a room thermostat operating the mixing dampers. Therefore, it is entirely practical to design the heater of a size sufficient to heat the total amount of air to the desired temperature (80° or 85° for ventilation or up to 120° or 140° for indirect heating), allowing this heater to remain on at all times. When the building has heated up and most of the air is being taken from the cool air bypass, the air in the hot air chamber will go way up in temperature possibly to 200° or so. To those who fear such a contingency a thermostat placed in the hot air chamber F and set at, say, 150°, would prevent such overheating without wobbling.

The usual practice, however, is to place a thermostat in the hot air chamber F, this being set at the desired air temperature so as to result in a constant and continued fluctuation of the heater H4. This is shown graphically in Fig. 5.

The second common arrangement of re-heaters is indicated in Fig. 6, where one large room is heated or ventilated and the temperature of all the air is controlled by controlling the re-heater. In this case the fan may be located either in the space D, or better, E, or the entire equipment may be placed on the suction side of the fan with the fan placed at F. If the fan is placed at D it will

handle saturated air; if at F, the hottest air; while if located at E, it will handle air at medium temperature and considerable above the dew point.

If two thermostats are used in the warm air chamber F similar to the arrangement shown in Fig. 5, the same oscillation will result, but if one thermostat is located in the room G and one in the space E, with the heater H3 giving 15° rise, the result is 70° air at all times when the room is up to proper temperature and any drop in room temperature below 68° promptly throws on heater H4, so that air at 90° (H4 giving 20° rise) is furnished until the room is brought back to normal. Under this condition H3 will still fluctuate.

If both thermostats should be located in the room G, as shown in Fig. 7, one set at 70° and one, say, at 65°, there is little liability of trouble. Then heater H3 will be on constantly unless the room overheats, while heater H4 will cut in, giving 90° air only when the room goes below 65°. The change in the room will be much more gradual than in a hot air chamber, with a corresponding reduction in trouble. The objection may be urged that when the room is overheated saturated air will be introduced, owing to both heaters being shut off. It must be remembered however, that this danger is only present *when* the room is over 70°, in which case the entering air will immediately become mixed with the room air and its temperature raised so as to make condensation very unlikely.

Another solution would be to split the heater H3 into two rows, one giving 5° rise at all times and without automatic control, while the second could give the other 10° rise, controlled just the same as the heater H3 shown.

Saturation Curves for Vapor, and Weight of Air

By A. BEMENT.

The writer has found that difficulty is often experienced in determining the amount of moisture required for humidification, owing to the absence of simple data. Weight of vapor is usually given in grains, a measure not dealt with in any other connection by engineers, and which must be transposed to pounds.

Therefore the curve Fig. 1 has been found useful. It shows weight of vapor at saturation from zero to 100° F. The vertical divisions of the diagram represent fractions of a pound and the horizontal divisions give the temperature.

To illustrate the use of the diagrams let it be assumed that it is necessary to humidify a room measuring 20 x 30 ft., with a height to the ceiling of 12 ft. Thus $20 \times 30 = 600$ and $600 \times 12 = 7{,}200$ cu. ft. in the room. Referring to Fig. 2, and taking the desired room temperature as at 65° and following the horizontal line from that figure to the curve, then down from that point to the bottom of the diagram two divisions beyond the figure 0.0750; then by adding to it 0.00050, we have 0.0755 as the weight of a cubic foot of air.

It is not always necessary to add this small amount, as the nearest figure of 0.075 is accurate enough for usual purposes. Therefore, 7,200 cu. ft. $\times$ $0.075 = 540$ lbs. of air in the room.

Referring to Fig. 1 it is found that the horizontal line at 65° intersects the saturation curve at 0.012 and $540 \times 0.012 = 6.48$ lbs. of moisture for full saturation, but as a 50% relative humidity may be desired, the moisture requirement is one half of that or, 3.24 lbs.

The air from out doors contains some moisture which would supply a part of the requirements. Assuming an outdoor temperature of 30° F., it is found from Fig. 1 that the weight of the vapor at saturation is about 0.00375, but as the average relative winter humidity is about 75% of saturation, this saturation figure is reduced by the difference and becomes 0.0028. Thus, $540 \times 0.0028 = 1.5$ lbs.

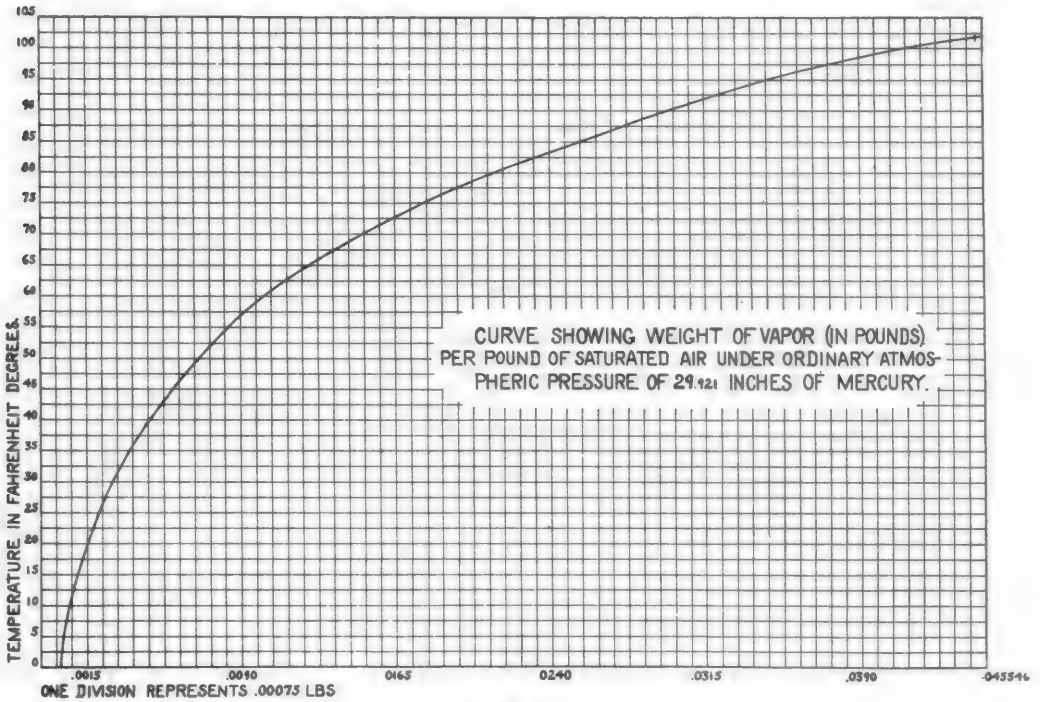

CURVE SHOWING WEIGHT OF VAPOR (IN POUNDS) PER POUND OF SATURATED AIR UNDER ORDINARY ATMOSPHERIC PRESSURE OF 29.921 INCHES OF MERCURY.
TEMPERATURE IN FAHRENHEIT DEGREES.
ONE DIVISION REPRESENTS .00075 LBS

FIG. 1.

Therefore $3.24 - 1.5 = 1.74$ lbs. of moisture to be supplied to cover the deficiency. This is the requirement for the air in the room, and is the amount that must be supplied per hour if the air is changed once per hour, but if changed oftener the required moisture will be in proportion to the number of changes.

It may be well to add to the foregoing that 1 lb. is equal to 7,000 grains.

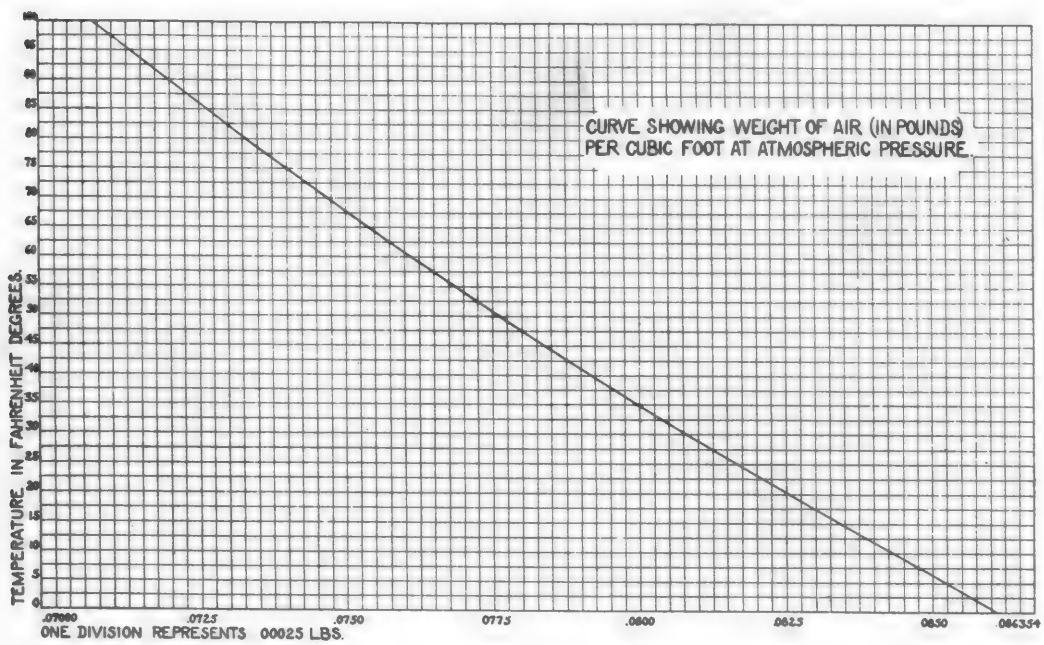
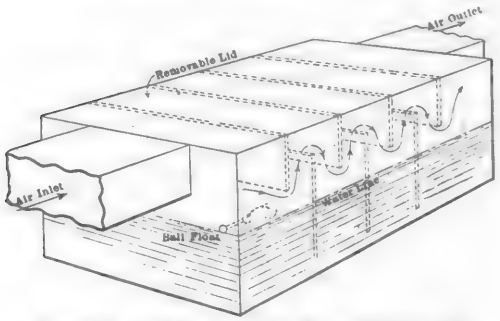

CURVE SHOWING WEIGHT OF AIR (IN POUNDS) PER CUBIC FOOT AT ATMOSPHERIC PRESSURE.
TEMPERATURE IN FAHRENHEIT DEGREES.
ONE DIVISION REPRESENTS 00025 LBS.

FIG. 2.

The Early History of Air Conditioning

The accompanying illustrations are intended to present in graphic form the early development of air conditioning, or purification and cooling, apart from the process of heating the air.

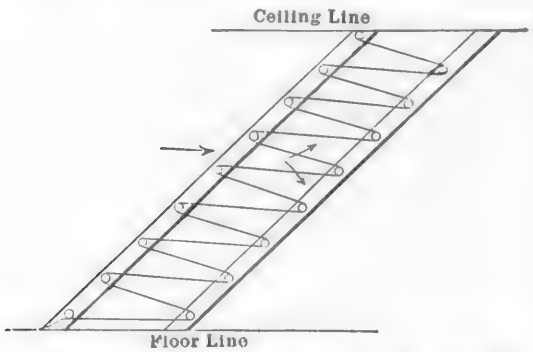
Probably the earliest method of accomplishing this was through the use of cheesecloth screens. Then came the coke tower or coke washer, which consisted of a compartment filled with coke, over which water was run continuously. The air came in contact with this coke and a certain amount of the dirt was washed



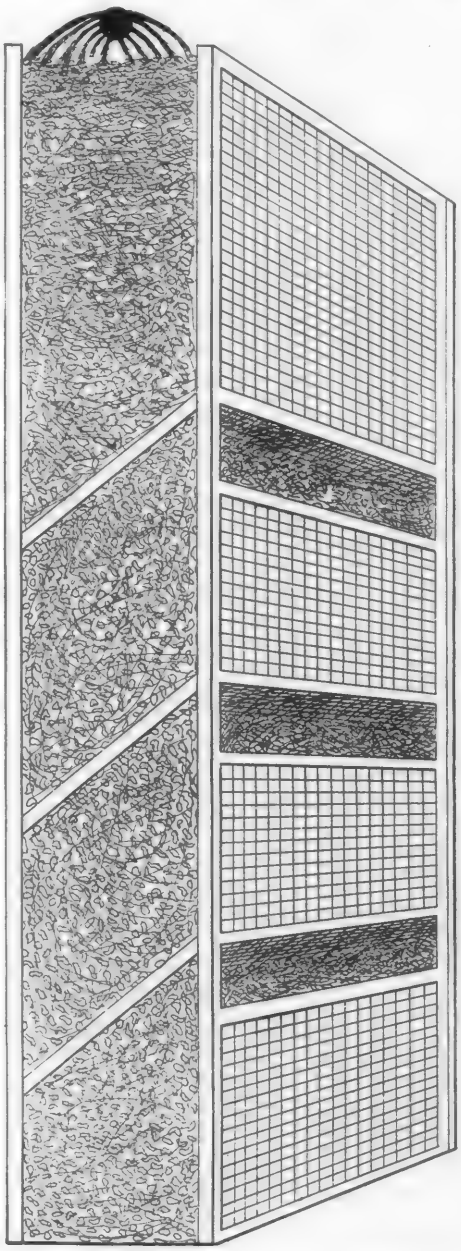
EARLY DEVICE FOR WASHING AIR.

out. The objection to the coke tower was that it became foul and, unless cleaned frequently, objectionable odors emanated from it, indicating imperfect cleansing.

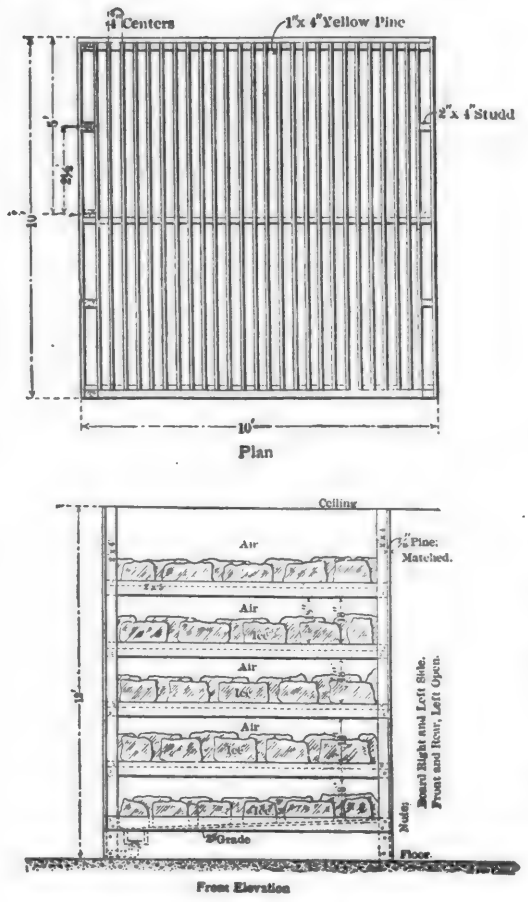
In the latter part of 1896, Joseph McCreery, who was then a prominent expert on ship ventilation, conceived the idea of passing water over a series of plates, so arranged that the air would be forced to make a tortuous passage and impinge against the wet surfaces of these plates. On July 13, 1897, he was granted a patent on his invention. This was the first all-metal wet air cleanser and was called an air washer. Undoubtedly this apparatus did not prove entirely satisfactory, because on June 6, 1899, Mr. McCreery was granted another patent covering an air washer that contained not only scrubbing



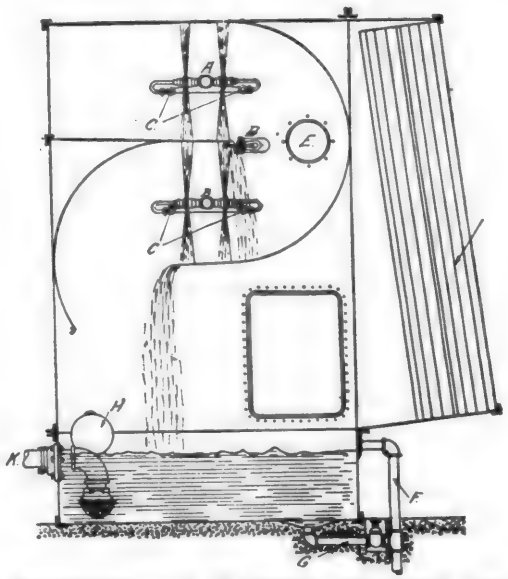
TYPE OF CHEESECLOTH FILTER FORMERLY USED IN BROOKLYN POST OFFICE.



COKE SCREEN USED FOR FILTERING AIR.



USE OF ICE FOR COOLING AIR IN SCHOOL BUILDING.



McCREERY AIR WASHER, SHOWING USE OF PRESSURE SPRAY HEADS.

plates, but also spray nozzles. This was the first patent granted covering the use of sprays for cleansing air.

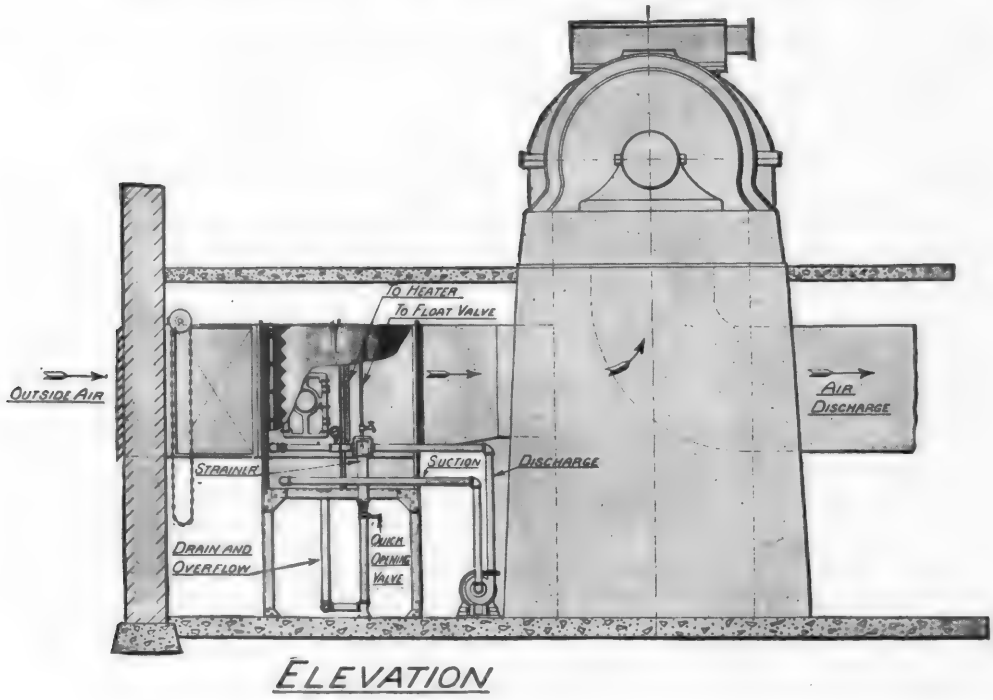
The various improvements made since that time and embodied in the various types now on the market, are of such recent development as to need no extended comment at this time. It is safe to say that the advances have been so rapid as to place American air conditioning practice in a class by itself

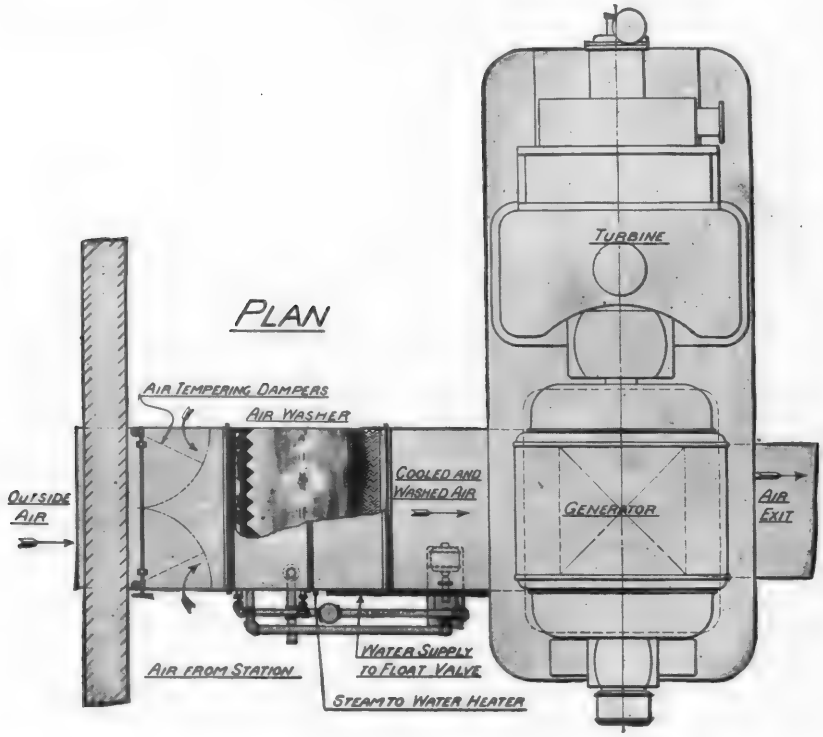
Washing and Cooling Air for Steam Turbine Generators

The proper ventilation of electric generators is a matter of great importance. All modern units are designed for a certain allowable maximum temperature in the armature and field windings. With a given load, the temperature of a generator will be a fixed amount above the temperature of the ingoing ventilating air; therefore, the cooler the air delivered to the generator, the greater will be its capacity.

Another equally important feature is that of the cleanliness of the ventilating air, and, unless proper equipment is provided to eliminate the dust or soot from the air, an accumulation of dirt is soon deposited within the machine, greatly reducing the cooling effect. Oily vapors that exist in air taken from the inside of power plants make such accumulations in the air passages particularly rapid. Dirty air, therefore, means excessive heat, which not only increases the ohmic resistance of the various windings, but shortens the life of the insulation, causing field-grounds and even burnouts unless the generator is taken apart and cleaned often. Therefore, the same consideration should be given to the quality as is given to the quantity and temperature of the ventilating air.

For this class of work a water-spray type of air washer and cooler is widely used, as well as air washers or humidi-





ELEVATION AND PLAN OF AIR-WASHER LAYOUT FOR TURBO-GENERATOR.

fiers used in ventilation work for public buildings, school houses and mills. The cloth screen type of filter is not available because of its liability to destruction by fire.

GAIN IN CAPACITY WITH COOL AIR.

As stated above, the safe load is based on a fixed maximum temperature attained by any part of the windings, which must be well below the critical temperature of the insulation. Cooling the air directly increases the capacity of the machine by allowing a greater temperature rise without exceeding a specified limit of temperature.

From curves giving the K. V. A. load on turbo-alternators as a function of the temperature of the entering air, it is shown, for example, that with air at 90° F. having a relative humidity of 45%, the safe capacity of the generator is only 87% of the full load rating. This is based on taking 100% load at 25° centigrade (77° F.) which is the standard air temperature for electrical machinery. If the air is passed through an air washer and cooler, it may be reduced to a temperature of 74° F. (23.3° C.) or less, enabling the generator to carry 102% load, resulting in a gain of approximately 15%, as the power required to operate the washer is but a fraction of 1% of the generator rating.

The amount that the air is reduced in temperature, depends on its temperature and humidity before it enters the washer. With higher initial air temperatures or lower humidities, the cooling obtained and, consequently, the gain in load carrying capacity will be greater. With average summer atmospheric conditions, the temperature of the air leaving the washer is usually between 60° and 70° F., which enables the generator to carry peak loads with perfect safety.

VALUE OF INCREASED CAPACITY.

An increase in the load carrying capacity of a generator means an increase in its earning capacity. The actual money value represented by a gain of only 5% on a 10,000 Kw. machine would be $5,000 for six months, based on a cost of $20. per kilowatt per annum, which does not take into consideration the saving in the cost of cleaning the generator. The gain in three months time on this basis would cover the cost of a washer installed complete, and provide a large return on the investment.

THE VALUE OF CLEAN AIR.

Few people realize the enormous quantity of air required for ventilating large turbo-generators. Assume, for instance, a moderately large generator using 65,000 cu. ft. of air per minute. This amount of air weighs approximately 2½ tons, so that within one-half to three-quarters of an hour a modern turbo-generator handles an amount of air equal in weight to its own total weight.

With 65,000 cu. ft. of air per minute passing through the machine, a total of 96,600,000 cu. ft. will be handled in twenty-four hours. As a rough approximation, it may be assumed that one hundred-millionth of the volume of the air in the vicinity of power plants consists of dust, dirt and other foreign particles. This would mean that 0.936 cu. ft. of dirt would pass through the machine in twenty-four hours, or 86 cu. ft. in three months. While, of course, a part of this dirt will pass directly through the machine, a portion will be deposited, due to the air swirls and eddies, in the air passages. As already pointed out, such deposits of dirt become a considerable handicap to the ventilation, as the quantity of air is decreased, due to the partial closing of the ventilating passages and the cooling effect of the air greatly diminished, owing to the fact that the air cannot come directly in contact with the heat-radiating surfaces.

EFFECT OF UNCLEAN AIR ON LIFE OF GENERATOR.

An item of even more importance, however, is the effect of unclean air on the life of the generator. A large percentage of all short circuits and burnouts of generators is due to foreign matter breaking down insulation resistance. Since a clean generator is comparatively free from such troubles, it is clear that an air washer may prevent a serious accident with a resulting loss many times exceeding the cost of its installation.

A 60,000 cu. ft. per minute Spraco washer is used to wash and cool the air for a 21,000 K. V. A. Westinghouse turbo-generator at the Long Island City, N. Y. plant of the Pennsylvania Rail-

road. The output of this one machine during the first twelve months of service, beginning January, 1915, was about 95,000,000 Kw-hours. That this machine was carrying its share of the load, is evidenced by the fact that 24 hours x 365 days x 21,000 K. V. A. x 80% P. F. is 147,000,000 Kw-hours, corresponding to a load factor of 64½%.

A D. C. voltmeter, connected with a copper strip exploring coil on the windings showed that not only were the windings cool, but that they were also free of foreign substances after fifteen months.

Only the highest grade of materials should be used in the construction of air washers used in this class of work, as the air in the vicinity of power plants usually contains elements which would cause rapid deterioration of inferior materials. In some localities the air is impregnated with various gases and matter soluble in water, which form the elements of a battery solution resulting in rapid galvanic action.

The Building of the Hospital*

With Segregated Costs of the Construction of Twenty-two Hospitals.

BY OLIVER H. BARTINE.

Superintendent of the New York Society for the Relief of the Ruptured and Crippled.

HEATING AND VENTILATING.

The degree of efficiency with which the building serves its purpose and is made comfortable and convenient depends most largely upon the character and completeness of its mechanical equipment. Quite as important also is the fact that the heaviest of the operating expenses of the hospital are those connected with the heating and power plant, and the extraordinary repairs and replacements necessary there.

Regardless of the differing views as to the status of artificial ventilation as applied to the hospital, there can be no disputing the fact that the heating plant of the hospital is a most important department. Provision must be made for the heating of the entire building and for a source of steam for laundry, kitchen and sterilizing work. Further, there should be thorough means of ventilating all toilets, kitchens (including diet kitchens), laundry and many other service rooms. Very few there are who do not believe in the importance of a complete artificial ventilating plant for the operating room. It is believed that the consensus of the best opinion also requires that there should be provided exhaust ventilation for all large wards, and in case of hospitals built in congested districts in the cities a supply of fresh air by means of an artificial ventilating system is also desirable.

A great deal is said of the success of natural ventilation, but it may be questioned whether the exponents of such a method of ventilation give proper consideration to the nuisance caused by open windows because of dust and noise, and to the effect of the dry air resulting from natural ventilation, as well as to the difficulty of controlling this method of ventilation.

Serious objections may be offered to any detail of the heating and ventilating equipment which is so arranged as to prevent thorough cleaning of all parts. To this end the hospital type of radiators should be used, these being constructed with an enlarged space between the radiator sections, and the radiators should be suspended from the walls with a space of not less than three inches, and preferably four inches, at the back of the radiators, and not less than five inches between the bottom of the radiators and the floor.

The ventilating grills should be so installed that they may be removed or be readily opened to permit of cleaning of the backs of the grills and the connecting ducts.

*From a paper read before the American Hospital Association.

TABLE NO. 1a. COST DATA

Building.	Cubiture of building.	No. of patients.	Cu ft. per patient.	Total cost of building. Total.	Per cu. ft.	Per patient.	Cost of heat. & vent. Total.	Per cu. ft.	Per patient.	Cost of electric system. Total.	Per cu. ft.
1	2,096,000	225	9,320	$897,166	$0.428	$3,987.00	$86,461	$0.04	$384.00	$26,399	$0.012
2	1,919,287	181	10,603	610,000	0.317	3,370.70	55,500	0.029	306.70	15,920	0.008
3	1,687,000	152	11,098	525,000	0.311	3,453.94	41,660	0.025	272.00	12,962	0.007
4	3,338,000	500	6,676	851,000	0.255	1,702.00	104,705	0.031	209.40	31,729	0.009
5	4,230,103	450	9,400	1,736,739	0.41	3,815.00	141,137	0.033	313.60	27,632	0.006
6	1,343,815	150	8,958	516,733	0.384	3,445.00	48,595	0.036	324.00	....	....
7	756,355	150	5,042	251,081	0.332	1,606.00	26,452	0.035	175.00	9,594	0.013
8	1,406,400	232	6,062	531,954	0.40	2,720.00	....	....	....	3,000	0.002
9	508,375	70	7,262	214,164	0.44	3,061.00	10,855	0.018	155.20	....	....
10	1,327,413	179	7,416	679,182	0.51	3,800.00	82,887	0.06	460.00	26,886	0.02
11	905,800	250	3,623	599,220	0.44	1,600.00	46,000	0.05	184.00	7,600	0.008
12	249,700	85	2,937	87,367	0.35	1,027.85	5,688	0.022	67.00	1,700	0.007
13	210,300	—	—	74,945	0.35	—	4,600	0.022	—	2,500	0.011
14	1,718,010	410	4,190	686,754	0.40	1,675.00	70,000	0.04	170.30	8,700	0.005
15	1,877,931	350	5,337	789,795	0.42	2,256.60	52,180	0.028	150.00	49,501	0.024
16	927,415	—	—	500,876	0.51	—	57,500	0.06	—	6,800	0.007
17	534,150	—	—	394,000	0.73	—	....	....	—	1,100	0.002
18	1,967,762	407	4,834	758,404	0.39	1,863.40	63,125	0.039	155.08	14,366	0.007
19	3,768,282	303	12,440	1,366,780	0.36	4,510.80	137,000	0.037	452.14	20,875	0.006
20	777,308	150	5,182	257,761	0.33	1,718.40	20.611	0.026	137.40	9,000	0.011
21	367,200	110	3,340	146,521	0.40	1,332.00	3,000	0.008	27.27	3,200	0.009
22	3,704,287	220	16,837	1,134,974	0.30	5,159.00	115,989	0.031	527.22	19,984	0.006
Avrge. cost p'r cu. ft..	.....	...	....	.....	0.382	....	....	0.033	....	....	0.009

*In power plant.

TABLE 1b. COST DATA

Building.	Cost of vac. cl. syst. Total.	Per cu. ft.	Per patient.	Cost of elevators. Total.	Per cu. ft.	Per patient.	Cost of laundry equipt. Total.	Per cu. ft.	Per patient.	Cost of kitchen equipt. Total.	Per cu. ft.	Per patient.
1	—	—	—	$22,225	$0.016	$99.00	$9,729	$0.004	$43.20	$3,239	$0.001	$14.30
2	$1,900	$0.001	$10.49	11,200	0.006	61.80	6,320	0.003	34.90	6,475	0.003	36.00
3	—	—	—	3,360	0.002	22.10	5,956	0.004	39.11	4,000	0.003	26.32
4	—	—	—	22,475	0.007	44.95	11,707	0.003	23.41	—	—	—
5	2,603	0.006	5.70	32,280	0.008	71.73	20,713	0.005	46.00	13,802	0.003	30.70
6	....	....	....	16.515	0.012	110.00	5,298	0.004	35.32	4,118	0.003	27.45
7	....	....	....	2,450	0.003	16.30	3,575	0.005	24.00	....	....	....
8	....	....	....	.....	....	....	4,954	0.004	21.40	9,000	0.006	39.00
9	—	—	—	.....	....	....	—	—	—	....	....	....
10	—	—	—	16,100	0.013	90.00	—	—	—	6,900	0.005	38.33
11	....	....	....	8,000	0.009	32.00	....	....	....	....	....	....
12	....	....	....	1,115	0.005	13.00	....	....	....	....	....	....
13	—	—	—	.....	....	—	16,000	0.08	—	—	—	—
14	5,575	0.003	13.60	6,200	0.005	15.12	....	....	....	....	....	....
15	5,985	0.003	17.10	19,000	0.01	54.28	....	....	....	....	....	....
16	2,400	0.002	—	8,000	0.009	—	53,382	0.059	—	—	—	—
17	—	—	—	1,500	0.003	—	—	—	—	—	—	—
18	3,625	0.002	9.00	7,625	0.004	18.73	....	....	....	....	....	....
19	....	....	....	16,500	0.005	54.45	....	....	....	....	....	....
20	4,500	0.005	30.00	9,000	0.01	60.00	....	....	....	....	....	....
21	....	....	....	2,700	0.008	24.54	....	....	....	2,500	0.007	22.72
22	....	....	....	5,855	0.0016	26.61	15,601	0.005	709.13	8,000	0.002	36.66
Avrge. cost p'r cu. ft..	....	0.0023	....	.....	0.007	....	....	0.017	....	....	0.0037	....

[1]Provides capacity for several other buildings. [2]No piping included. [3]Large amount of piping involved.

—HOSPITAL BUILDINGS

Cost of electric system.		Cost of electric fixtures.				Cost of plumbing system.				Cost of refrig. plant. incl. boxes.		
Per patient.	Per outlet.	Total.	Per cu. ft.	Per patient.	Per fixture.	Total.	Per cu. ft.	Per patient.	Per fixture.	Total.	Per cu. ft.	Per patient.
$111.00	$16.50	$7,971	$0.003	$35.40	$7.00	$61,789	$0.029	$274.00	$226.40	$17,308	$0.008	$77.00
88.00	....	3,250	0.002	18.00	...	45,800	0.023	253.04	....	16,900	0.008	93.92
85.00	7.35	5,000	0.003	32.89	6.39	37,500	0.022	246.05	143.70	13,700	0.008	90.13
63.46	....	9,772	0.003	19.54	...	55,332	0.013	110.60	....	25,947	0.008	51.88
61.40	8.00	10,000	0.002	22.22	5.80	109,664	0.026	243.70	165.65	37,722	0.009	83.82
....	....	3,575	0.002	24.83	...	32,600	0.024	217.33	150.00	.....	....	....
63.90	10.90	2,180	0.003	14.40	6.00	23,000	0.03	153.00	135.00	5,300	0.007	35.50
14.90	....	....	....	....	...	....	....	....	....	.....	....	....
....	....	....	....	....	...	....	....	....	....	3,368	0.007	48.10
149.00	13.00	6,561	0.005	36.00	6.32	65,265	0.05	362.50	253.00	21,211	0.01	118.00
34.00	....	....	....	....	...	17,000	0.019	68.00	....	.....	....	....
20.00	....	....	....	....	...	6,200	0.025	73.00	....	443	0.002	5.21
—	....	....	....	—	...	2,525	0.012	—	....	.....	....	—
21.22	....	3,640	0.002	9.00	...	51,439	0.03	125.45	....	.....	....	....
141.50	....	9,750	0.005	28.00	...	72,840	0.04	208.11	....	40,000	0.021	114.30
—	....	1,744	0.002	—	...	85,000	0.09	—	....	62,000	0.066	—
—	....	....	....	....	...	10,000	0.018	—	....	.....	....	....
35.30	....	4,000	0.002	9.82	...	62,650	0.032	154.00	....	6,882	0.003	17.01
68.72	....	6,823	0.002	22.51	...	111,200	0.03	363.70	....	58,250	0.017	192.24
60.00	....	....	....	....	...	20,900	0.02	139.33	....	3,500	0.004	23.33
29.09	....	2,540	0.007	23.09	...	12,197	0.038	110.90	....	.....	....	....
90.83	....	5,938	0.002	27.00	...	102,614	0.019	467.00	....	7,433	0.002	33.80
....	....	....	0.003	....	...	....	0.029	....	....	.....	0.012	....

—HOSPITAL BUILDINGS

Cost of power plant.				Percentage contracts bear to total cost of building.										
Total.	Per cu. ft.	Per patient.	Per K.W.	Building.	Heat. & vent.	Electric.	E. fixtures.	Pl'bing.	Refrig.	Vac. cl'n.	Elevators.	Laundry.	Kitc'n.	Power plant.
$15,000	$0.007	$66.66	$75.00	72.2	6.9	2.9	0.9	6.9	1.9	—	2.5	1.1	0.4	1.6
7,400	0.004	40.90	30.00[2]	73.4	8.1	2.6	0.5	7.5	2.8	0.3	1.8	1.0	1.0	1.0
7,078	0.004	46.50	70.78	75.2	7.9	2.5	0.9	7.1	2.6	—	0.64	1.1	0.76	1.3
15,440	0.005	30.88	44.11[2]	67.1	12.3	3.7	1.1	6.5	3.5	—	2.6	1.4	—[1]	1.8
21,570	0.005	47.90	95.86	74.26	8.1	1.8	0.6	6.4	2.1	0.15	2.6	1.4	0.79	1.8
.....	....	....	....	...	9.4	0.6	..	6.3	..	..	3.2	1.2	0.8	..
4,530	0.006	30.00	75.00	...	10.2	4.6	0.8	9.2	2.1	..	1.0	1.4	..	2.0
—	—	—	—	...	...	0.6	..	..	..	..	..	0.9	1.6	—
14,176	0.028	202.50	141.00[2]	...	5.0	...	..	..	1.5	—	..	—	..	6.6[1]
.....	....	....	....	...	12.0	4.0	1.0	9.6	3.1	—	2.4	—	1.1	..
.....	....	....	....	...	11.8	2.0	..	4.6	..	..	2.0	..	..	..
.....	....	....	....	...	6.9	2.0	..	7.0	0.5	..	1.3	..	..	..
—	—	—	—	...	6.1	3.3	..	3.4	—	—	—	21.3	—	—
.....	....	....	....	...	10.2	1.3	0.6	7.5	..	0.8	0.9	..	..	..
†	....	....	....	...	6.6	6.02	1.3	9.3	5.8	0.8	2.5	..	..	..
—	—	—	—	...	11.5	1.3	0.3	16.0	12.3	0.4	1.6	10.6	..	..
161,500	0.302	—	....	...	...	0.3	..	3.0	..	..	0.5	..	..	41.0
.....	....	....	....	...	8.4	1.9	0.5	8.3	0.9	0.5	1.0	..	..	..
.....	....	....	....	...	10.0	1.6	0.5	8.9	4.3	..	1.2	..	..	..
.....	....	....	....	...	8.0	3.5	..	8.0	1.3	1.7	3.5	..	..	..
.....	....	....	....	...	2.0	2.0	1.9	8.0	..	..	2.0	..	2.0	..
66,000	0.018	300.00	....	...	10.2	1.7	0.4	9.0	0.6	..	0.5	1.4	0.7	6.0
.....	0.047	....	....	72.44	7.2	2.4	8.0	7.6	2.9	0.80	1.76	3.9	1.01	7.0

†In electric system.

POWER PLANT.

The question of the advisability of the installation of an electric power plant depends only upon the size of the hospital. Wherever fire room service for twenty-four hours is necessary and boilers of 100 H. P. capacity or greater are required, there can be little doubt as to the advisability of installing an electric power plant. In practically all hospitals steam at sixty pounds pressure is required for sterilizing purposes and also for laundry purposes. Steam also is required for cooking purposes at 40 pounds pressure. The piping system for the sterilizing and laundry work may be combined, but the cooking apparatus should be provided with a separate system of piping, while the heating is connected with still another separate system of piping. Thus the steam must be generated originally at 60 pounds pressure and be reduced to 40 pounds pressure for cooking and to approximately 2½ pounds pressure for heating purposes. It is just as easy and quite as economical to generate steam at 80 to 100 pounds, or even 125 pounds pressure, for the operation of engines for driving electric generators.

In the summer, when heat is not required, a considerable proportion of the exhaust steam may be utilized for heating

COST DATA TABLE Nº 2 HOSPITAL BUILDINGS

BUILDING		1	2	3	4	5	6	7	8	9	10	11	12	13		AVERAGE COST PER CU. FT.
CUBITURE OF B'L'D'G		905,800	249,700	210,300	1,327,413	1,718,010	1,877,931	327,415	554,180	1,967,762	3,768,282	777,508	367,200	2,036,098		
COST OF CONSTRUCT'N		320,620	72,221	43,320	441,682	541,214	540,539	224,050	219,300	594,131	1,016,152	190,250	120,384	647,045		
COST OF MECH. EQUIPM'T		78,600	15,146	25,625	237,500	145,540	243,256	276,826	174,100	164,273	550,648	67,511	26,187	250,121		
TOTAL COST OF B'L'D'G		399,220	87,367	74,945	679,182	686,754	783,795	500,876	394,000	758,404	1,566,780	257,761	146,821	897,166		
EXCAVATION	TOTAL	22,220	1,110	2,500	28,541	33,000	40,000	40,000	33,600	79,750	158,000	8,000	4,917	50,895		
	PER CU. FT.	.024	.004	.011	.025	.019	.021	.043	.063	.041	.056	.007	.015	.025		.026
MASONRY	TOTAL	111,700	25,216	23,420	173,503	260,950	196,760	91,080	105,300	249,147	417,085	71,650	53,634	222,878		
	PER CU. FT.	.12	.10	.11	.132	.152	.105	.098	.198	.127	.111	.092	.146	.12		.124
STRUCTU'L STEEL & IRON	TOTAL	33,450	11,500	9,500	33,938	66,000	90,414	25,000	37,500	71,738	115,730	33,100	17,000	80,648		
	PER CU. FT.	.06	.03	.04	.045	.038	.048	.038	.070	.036	.031	.043	.046	.04		045
CARPENTRY	TOTAL	20,400	7,400	6,500	46,848	58,500	60,000	22,000	5,800	65,565	61,000	13,025	12,000	71,225		
	PER CU. FT.	.022	.03	.03	.035	.032	.032	.024	.018	.033	.016	.024	.033	.035		.028
ROOFING	TOTAL	18,000	5,800	3,000	9,700	9,319	48,365	8,100	3,500	13,525	41,667	In Steel & Iron	6,367	25,080		
	PER CU. FT.	.02	.02	.014	.007	.005	.026	.009	.016	.007	011	—	.024	.011		.010
GLASS & GLAZING	TOTAL	In Carpentry			In Carpentry	In Carpentry	In Carpentry		In Carpentry		36,000	1,000	400	6,202		
	PER CU. FT.	—			—	—	—		—		.0085	.001	.001	.003		.0036
SKYLIGHTS & SHEET METAL	TOTAL	In Roofing			In Roofing	In Roofing	In Roofing		In Roofing	In Roofing	In Roofing	8,525	In Roofing	In Roofing		
	PER CU. FT.	—			—	—	—		—	—	—	.011	—	—		.011
PAINTING	TOTAL	5,000	1,095	350	In Carpentry	4,250	In Carpentry		In Carpentry	3,564	In Carpentry	In Carpentry	3,000	26,478		
	PER CU. FT.	.005	.005	.004	—	.002	—		—	.002	—	—	.014	.013		.006
LATHING & PLASTERING	TOTAL	10,060	2,660	1,750	16,500	22,800	20,000	6,000	400	20,225	37,500	15,000	10,060	41,237		
	PER CU. FT.	.01	.017	.008	.012	.013	.011	.007	.0008	.01	.01	.008	.027	.026		.0123
COMPOSITION FLOORING	TOTAL				13,103	20,000	14,000		3,000		29,000	3,730	In Masonry	6,106		
	PER CU. FT.				.01	.015	.008		.003		.008	.002	—	.004		.006
TILES, MOSAICS & MARBLE	TOTAL	46,000	17,000	1,200		18,200	31,000	1,500	800	41,260	65,600	11,000	2,886	63,029		
	PER CU. FT.	.05	.07	.006		.016	.017	.0016	.0015	.021	.0174	.014	.008	.031		.0211
HARDWARE	TOTAL	4,850	440	In Carpentry	In Carpentry	4,100	5,000	400	400	5,125	3,500	2,200	In Roofing	3,080		
	PER CU. FT.	.005	.002	—	—	.002	.003	.0004	.0008	.0026	.0025	.0028	—	.004		.005
CAST IRON	TOTAL	27,000	In Steel & Iron	In Steel & Iron	30,000	43,035	35,000	20,000	21,500	44,210	35,000	18,000	5,500	44,189		
	PER CU. FT.	.03	—	—	.023	.013	.019	.022	.04	.022	.009	.024	.015	.022		.022
BRONZE & BRASS WORK	TOTAL															
	PER CU. FT.															
TOTAL COST PER CU. FT.		.44	.35	.35	.51	.40	.42	.51	.73	.39	.36	.33	.40	.428		.432

water for laundry purposes, for heating driers and for other purposes.

In many such plants the electric current is being made at a cost of one cent per K. W. H., and one of our largest New York hospitals made their electric current for ⅝c per K. W. H. In another of our New York hospitals an installation costing $17,000, and including electric power plant and refrigerating plant, resulted in a saving of $7,100 annually.

COSTS.

A great deal has been written concerning the cost of hospital buildings. Any statement of cost based upon the cost per bed may be misleading to the trustees, superintendent and others. For instance, a hospital caring for a special class of patients requiring extra rooms and special equipment cost $4,000 per bed. If the same building had been planned as a general hospital beds could have been placed in the special extra rooms mentioned, thus increasing the bed capacity of the building to such an extent that the cost of the building would not have exceeded $3,000 per bed. This hospital has special employees for special purposes and rooms, but perhaps not as many as would be required to care for the extra number of patients which might have been accommodated in the special rooms, but even after making liberal allowances for these conditions it is found that this hospital would not have cost over $3,300 per bed if used as a general hospital instead of $4,000 per bed as it actually cost, based upon the number of patients accommodated.

After making a careful study of this matter of costs the author has come to the conclusion that a better basis of determining the cost of the hospital building is the cost per cubic foot. In determining the number of cubic feet of the hospital, measurements should be taken from the basement or sub-basement (lowest) floor level to the mean of the outside of the roof, and from outside to outside of walls. In other words, the cubic feet of air displaced by the exterior dimensions of the building should be considered, eliminating approaches, balustrades and other projections not enclosing space.

It is true that it is quite possible to be wasteful in space, so that the cubic feet of space per patient may also well be given consideration.

In table No. 1 are presented segregated costs of the construction of twenty-two hospitals and hospital buildings. In the case of hospital No. 22 the cost per patient is shown to be $5,159, which is very high, while the cost per cubic foot is shown to be 30 cents, and this is very low.

It has been stated that no hospital building should cost in excess of 30 cents per cubic foot, but it will be observed by reference to this table that rarely is a general hospital built at such a low cost. The fact of the matter is that local conditions, the character of the hospital and its work, and the elaborateness of the structure must all be carefully considered in determining the price per cubic foot. Eliminating No. 17 (which is a boiler house), the cost per cubic foot of all of the hospitals listed averages .382 cent. The cost of the heating and ventilating equipment per cubic foot averages .033 cent (after eliminating No. 9, which included no boiler plant).

The cost of the electric system averages 1 cent per cubic foot; electric fixtures average .003 cent per cubic foot; plumbing averages .029 cent per cubic foot (omitting No. 16, which is a laundry building); refrigerating plants average .012 cent per cubic foot; vacuum cleaner systems .002 cent per cubic foot; elevators .007 cent per cubic foot; laundry equipment (excluding Nos. 13 and 16, which are purely laundry buildings) .004 cent per cubic foot; kitchen equipment .004 cent per cubic foot; power plants average .005 cent per cubic foot. Thus the construction of the building (exclusive of its fixed equipment) averages .273 cent per cubic foot, as shown by this list.

Table No. 2 gives a segregated statement of the cost of hospital buildings exclusive of equipment, in the case of thirteen hospitals.

In the case of certain items, as masonry, the cost per cubic foot corresponds very closely in the case of practically all of the hospitals listed.

THE HEATING AND VENTILATING MAGAZINE

Vol. 13 July, 1916 No. 7

PUBLISHED MONTHLY BY THE
Heating and Ventilating Magazine Co.
1123 BROADWAY, NEW YORK

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Subscription	$1.00 per year
Canada	1.25 " "
Foreign countries	1.50 " "
Back numbers	15 cents each
Back Nos. prior to current year.	25 cents each

A PROPOSAL to change the name of the National Association of Master Steam and Hot Water Fitters deserves more than passing notice, not because it is likely to be adopted, but because it shows the trend in the development of this industry. As was stated in favor of the proposal, the general conception of a "fitter" is of a man who screws up pipe, and the use of the old-fashioned "master" in the title does not by any means convey an adequate meaning to the public. As was pointed out, the members of this association are not steam fitters or even master steam fitters. They are, at the least, heating contractors and many of them can lay claim to even a higher title.

Why, then, should the trade continue to do business under an outworn, misunderstood and clumsy title that does not properly represent its position or activities? Many heating contractors seldom see the jobs they have in hand and when visits are made to them, it is usually for the purpose of inspection and general supervision. These men fail to rise to the dignity of their calling when they are willing to pass in the general estimation as mere master fitters when they can rightfully assume the position of experts and contractors for the heating equipment.

Some such substitute as "The National Association of Heating Contractors," is suggested. This is practically as comprehensive as the longer name and has a force that is quite lacking in the present title.

The fact is that the heating trade, as well as the heating profession generally, has never fully risen up to its opportunities. It has too long been content to be a mere trade, rather than a distinct technical industry. Now, it would seem, is the opportunity to take a step forward in the interest of improving the status of the heating man, and while it would be a good thing to have the master steam fitters adopt the proposed title, it is even more important for the trade to begin to accustom itself to a more comprehensive designation.

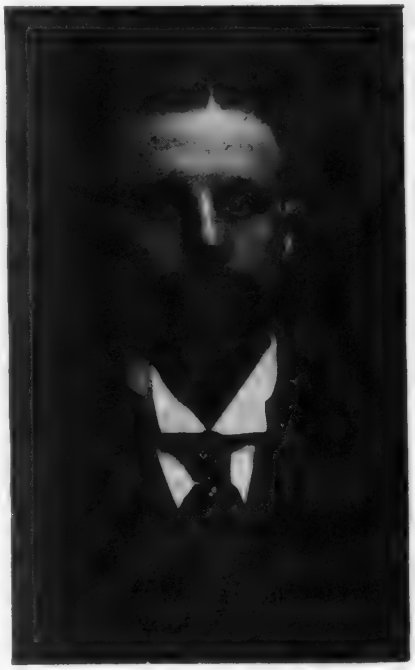
"WHAT is the matter with the steam fitting business?" asked President Bradley at the convention of the National Association of Master Steam and Hot Water Fitters. It may be that in the foregoing may be gained some inkling of the trouble. At any rate, with the growing practice of "delivering on the job" the heating contractor does not require the same quarters and equipment as in former days and some surprising instances may be seen of men who are doing an astonishingly large contracting business from a shop hardly worthy of the name.

It is becoming increasingly evident that the contractor of the future will do his work without the same "show" as in the past and he will need all the more to have his abilities and profession suitably designated to maintain his proper rank in the business community.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Twenty-Eighth Annual Convention, Atlantic City, N. J., June 21-24, 1916

As an occasion for plain speaking on the evils and shortcomings of the trade, the twenty-eighth annual meeting of the National Association of Master Steam and Hot Water Fitters will go down in history as one of the most remarkable of its kind ever held. In the presence of a notably large gathering, including many of the association's oldest members, the delegates were urged, as Judge John C. Karel, of Milwaukee, expressed it, to "get down to brass tacks," and instead of looking only for the abuses in the methods of the manufacturers, to frankly acknowledge their own faults and seek a way to correct them. "There is too much hypocrisy in your own ranks," declared Judge Karel. "You are too suspicious of your fellow-craftsman and your conceit leads you to believe that you are cleverer than your associate or competitor. So long as suspicion lurks among you, you will not be successful as a craft."



JUAN A. ALMIRALL,
President National Association of Master Steam and Hot Water Fitters.

Judge Karel also expressed the opinion that the name of the association was a misnomer and urged the members to get away from the term "fitter." "A fitter," he declared, "is a man who screws up pipe. You gentlemen are not fitters. You are heating contractors and this should be expressed in the title of your organization," a remark which brought forth a storm of applause.

OPENING SESSION, JUNE 22.

The convention met in the St. Charles Hotel, with President John T. Bradley in the chair. Following the meeting of the board of directors on Wednesday, June 21, the first regular session was called to order Thursday morning. Mayor Bacharach of Atlantic City welcomed the delegates and made a sally that was highly appreciated when he said that at the master plumbers' convention he was assured that there were no steam fitters present, only honest men, and here he was given equal assurance that there were no plumbers about, but only honest men.

President Bradley then presented his address. Following are some of the principal points he made:

With all sort of agitation about us; with various brands of legislation to confuse and confound us; with all kinds of difficulties to contend with, we ought to be thankful that we are permitted to assemble and talk over our own affairs.

"What is the matter with the steamfitting business?" is a question repeatedly asked.

Is it getting the return that its investments and efforts merit? Are the times

and conditions to blame, or should we look to ourselves to determine what is to be done to make the results worthy of the effort put forth? Are we wasteful? Are we ignorant? Do we understand our business? If this convention can answer some of these questions and offer suggestions that will be beneficial, who can then say that, besides its many activities, the National Association of Master Steam and Hot Water Fitters is not of the greatest possible service?

There is one subject that crops up continually at meetings or conventions which seems to hold the attention no matter what line of business the association represents. It is "co-operation between the wholesaler and the retailer," and as we are the retailers and the manufacturers are the wholesalers why not try to find a way that is morally and legally right for us to co-operate? And who needs most protection from the inroads of all kinds of pernicious interference? Why, it is the master steam fitter in the medium-sized town throughout the country.

Again we say, if a proper way can be found by which mutually satisfactory co-operation between National Associations in our line of business can become effective, then will this National Association have done for the craft and the public that which it is impossible to accomplish as individuals—but we do not, any of us, wish to run counter to what is just or lawful. We can, however, express the hope that the day is not far distant when through the Federal Trade Commission, perhaps, or some other Governmental source, we will be helped and not hindered in effort to place the business of steamfitting on a basis where it will produce a living and something besides for those who risk their capital, small or large, and who give up their best years in its conduct.

We everyday business men want to co-operate—not only with the Government, but with each other in placing our own business in a position to serve our customers both by furnishing high grade quality of goods and excellent service. All of this can be helped by co-operation.

The objective of our association is not only that men in our line of business shall receive but that they shall give—give in service for others. And we can point with considerable pride to unselfish giving by men who had a part in the inauguration of this association some twenty-eight years ago, and some of them are members to-day.

The National Association does not attempt the influencing of either National or State legislation, but it does give such close attention as is consistent to legislative matters at times, and co-operates with other associations, making legislative matters a specialty; on matters that affect the craft.

We must not be at all discouraged because everything desirable to accomplish has not become a fact, even after a few years' efforts have been expended.

The substantial character of our membership is a subject for congratulation, particularly in view of the peculiar conditions that have prevailed during the last two years. Our membership is not far from its high-water mark and such losses as we have sustained have been offset, to a large degree, by additions of members from quarters where we have not heretofore been actively represented.

The financial position of the association is stronger than we had reason to hope for when the business conditions in our line are taken into consideration and allowances made for the failure to meet obligations by members who should have done so before April 30, when our books for the fiscal year closed.

Not wishing to anticipate other reports to be presented at the proper time, I will be content to say that it is a source of great gratification to have our treasurer and secretary inform us that never in the history of the association, so far as they know, have the good assets exceeded the liabilities by such a substantial amount as will be shown by their reports.

On the conclusion of his address President Bradley introduced Judge John C. Karel, of Milwaukee, who was one of the principal speakers at the association's convention in Milwaukee last year.

Judge Karel commenced his remarks by paying a tribute to the retiring president, Mr. Bradley, and referred to his loyalty to the association, especially during the years when he was the sole representative in St. Louis. "When Mr.

Bradley could not induce his associates in his home city to see the advantages of association work," said Judge Karel, "he was not the kind to lose heart, but went ahead and held a convention by himself, being chairman and all the other officers as well. He stuck to his guns and to-day he has the satisfaction of seeing a score or more of delegates from St. Louis present at this convention."

Judge Karel then presented President Bradley, on behalf of the association, with a gold watch and gold pocket knife. As Mr. Bradley rose to receive the gifts he was greeted with prolonged applause which testified even more strongly to the esteem of his associates.

He was noticeably moved by the ovation accorded him, but found words to express his thanks. "Most men," he said, "have to die to learn how much they are appreciated. I am lucky in that respect and I thank you."

Judge Karel's Address.

Judge Karel then proceeded with his formal address, which took the form of a thoughtful review of the association, its defects, its needs and its opportunities. Convention-goers, he said, may be divided into three classes: (1) the earnest workers; (2) those who consider the convention a clearing house for ideas, where business yarns are swapped and experiences told, and (3) those who know little and care less, who look upon the convention simply as an outing. The first two classes derive benefit from the convention, but the third class is wasting its time as far as furthering their business interests is concerned.

Heating contractors must find a way to be successful. You should have organizations in every State, instead of in six. Last year in Wisconsin 28 bills detrimental to the heating contractors' interests were killed by the Milwaukee association.

Turning to the shortcomings of heating contractors, Judge Karel said: "There ought to be no question about honor among you and yet when one of your number presents a report containing anything new or different, many of you ask yourselves, 'I wonder what he had in his mind when he wrote that.' You are often looking for some ulterior purpose. There is a constant lack of confidence among yourselves. You are not playing the game with all the cards above the table. As long as this suspicion lurks among you, you will not be successful as a craft."

Judge Karel put himself in the place of the manufacturer and asked how the contractors could expect generous treatment from them when they were not themselves playing fair towards the manufacturer.

"In the awarding of contracts, I believe in competition, but is not reputation an asset to be considered? There ought to be some other way of awarding contracts than by giving them to the lowest bidder. I would recommend a system of cost plus a percentage. This I tried out in a modest way in the construction of my own home in Milwaukee, and it worked successfully. The only trouble arose over the carpentry work, and that was the one item that was done on the low-bid basis."

Judge Karel's address was easily the sensation of the convention, and while many felt he had been unsparing in his criticism, at the same time he had given expression to ideas that had long been known to the members themselves but generally avoided in convention discussions.

F. W. Herendeen's Address.

The next speaker was F. W. Herendeen, secretary of the National Association of Boiler and Radiator Manufacturers. Mr. Herendeen delivered a prepared address which, he said, had been approved by his association. He bespoke a deeper appreciation, on the part of the heating contractors, of the work of the boiler and radiator manufacturers' association. He said that during the past year no less than forty bills had been introduced in eight State legislatures relating to some features of the trade. These included bills for the compulsory inspection of house heating boilers and State licenses for firemen. His association was organized to keep watch of such impending legislation and had been successful in many cases in blocking it. The association was also interested in seeing that nothing detrimental was added to the recently enacted A. S. M. E. boiler code, especially on the part of the boiler insurance companies.

He said the association had four freight classification committees in the country for the purpose, among other things, of opposing improper rates. This matter, he said, was of just as much importance to the heating contractor as it was to the manufacturer, for the payment of excessive freight rates was a burden that affected both parties.

Mr. Herendeen urged an interchange of thoughts and ideas on the part of the two associations and said that one of the reasons why steam and hot water heating is not more generally on a profitable basis is because the items of cost, overhead expense and profit are not properly co-ordinated. Of a year's failures in the heating contracting trade only 5.7 per cent. were due to competition, the great majority being caused by incompetence and lack of capital.

According to the way many contractors are running their business, the manufacturer capitalizes the contractor, without interest. Contractors who expect this accommodation should be prepared to furnish the manufacturer with financial statements.

Mr. Herendeen said the capital invested in the heating industry was notably moderate compared to the amount of business transacted. The merchant should make his bank a partner in his business. "Discuss your affairs," he urged, "with your bank."

Another point taken up by Mr. Herendeen was the use and abuse of discounts. Many people are not aware of the fact, he said, that they can borrow money at 6 per cent. interest and discount their bills and come out ahead. One of the principal abuses in the trade is the delay in taking discounts, as it works a hardship not only on the contractor, but on the manufacturer as well.

Mr. Herendeen included in his paper a list of the members of the National Boiler and Radiator Association, as follows:

American Radiator Co., Chicago, Ill.
Atlantic Radiator Co.
Boynton Furnace Co., New York.
W. A. Case & Son Mfg. Co., Buffalo, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Hitchings & Co., Irvington, N. Y.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Lord & Burnham Co., Irvington, N. Y.
J. H. McLain Co., Canton, O.
L. J. Mueller Furnace Co., Milwaukee, Wis.
National Radiator Co., Johnstown, Pa.
Niagara Radiator & Boiler Co., No. Tonawanda, N. Y.
Federal Radiator Co.
Peerless Heater Co., Pittsburgh, Pa.
Pierce, Butler & Pierce Mfg. Corporation, New York.
Richardson & Boynton Co., New York.
Richmond Radiator Co., New York.
H. B. Smith Co., Westfield, Mass.
Spencer Heater Co., Scranton, Pa.
Thatcher Furnace Co., New York.
Union Radiator Co.
Utica Heater Co., Utica, N. Y.
Williamsport Radiator Co., Williamsport, Pa.

Committee Appointments.

The following committee appointments were announced:

CREDENTIALS.

Harry G. Black, Pennsylvania; Theodore M. Hunt, Missouri; Robert Berla, New Jersey; E. A. Wheeler, Maine; Charles J. Fox, Wisconsin.

NOMINATING.

Alfred E. Kenrick, Massachusetts; Frank H. Meadows, Wisconsin; William Hunter, Missouri; W. F. Hughes, Pennsylvania; Ernest T. Child, New York.

CONSTITUTION AND RULES.

N. Loring Danford, New York; J. Hokom, California; Edward Kanney, Indiana.

APPEALS AND GRIEVANCES.

Frank G. Carthey, Utah; L. B. Brickenstein, North Carolina; Walter Klie, Ohio.

ASSOCIATION IMPROVEMENT.

J. A. Ziesse, Michigan; S. A. Meeker, Connecticut; William Eckert, Washington.

AUDITING.

Charles A. Geoghegan, New York; Earnest T. Child, New York; William H. Curtin, New York.

DISTRIBUTION OF REPORTS.

Elias D. Smith, New York; James Barry, Missouri; Theodore Karr, Jr., Illinois.

RESOLUTIONS.

Stewart A. Jellett, Pennsylvania; Robert S. Parks, Massachusetts; Horace W. Jones, New York.

Afternoon and Evening Sessions, May 22.

A feature of the afternoon session was an address by Dr. Hobert C. Dickinson, physicist of the Bureau of Standards, in Washington, on the work of that department. His address was illustrated by lantern slides. One of the principal functions of the Bereau of Standards is to make tests of materials used in its specifications for government work. The testing apparatus includes

appliances for measuring heat transmission losses, and Dr. Dickinson said that the methods used and the accuracy of the results obtained compared favorably with the best practice, including the methods used in France, Germany and England.

In the evening an illustrated lecture on the navy and preparedness was delivered by Captain Charles L. Poor, field secretary of the Navy League of the United States. The Navy League is working for a higher state of preparedness and efficiency in the navy and the lecture was a plea for greater interest in this matter.

FRIDAY SESSION, MAY 23.

After an executive session in the morning, the convention met at 2 o'clock for the election of officers. The following were unanimously elected:

NEW OFFICERS.

President, Juan A. Almirall, New York.

Vice-presidents, W. H. Oakes, Boston, Mass.; Frank G. Carthey, Salt Lake City, Utah, and Edmund Grassler, Milwaukee, Wis.

Treasurer, J. E. Rutzler, New York.

Board of directors, John T. Bradley, St. Louis, Mo.; Noble P. Bishop, New Haven, Conn.; N. Loring Danforth, Buffalo, N. Y.; Julius A. Ziesse, Grand Rapids, Mich.; Juan A. Almirall, New York; W. H. Oakes, Boston, Mass.; Frank G. Carthey, Salt Lake City, Utah; Edmund Grassler, Milwaukee, and J. E. Rutzler, New York.

Sergeant-at-arms, John C. F. Trachsel, Philadelphia, Pa.

The retiring president then called Past President Elias D. Smith to the chair to install the new officers, and he performed this duty with a touch of military discipline that was apropos of the times.

An address by Edward N. Hurley, chairman of the Federal Trade Commission, was read by Sercetary H. B. Gombers. Mr. Hurley had expected to present his address in person, but was detained in Washington. Mr. Hurley called special attention to the present attitude of the government toward business and spoke of the government's constructive aid which was being found to be more helpful than court actions. Business data of all kinds are being gathered by the commission which will be distributed as widely as possible for the benefit of business men.

"The Relation of the Architect and the Master Steam Fitter" was the subject of an address that concluded the open session of the convention. This address was delivered by W. Knickerbacker Boyd, fellow of the American Institute of Architects, and discussed the matters of separate contracts and the use of manufacturers' names or brands in specifications.

After a further executive session the convention adjourned.

A subsequent meeting of the new board of directors was held at which N. Loring Danforth was elected chairman of the board and H. B. Gombers was re-elected secretary.

Convention Notes.

One of the notable absentees from the convention was William G. LeCompte, of Jenkins Bros., who, as chairman of the Manufacturers' and Salesmen's Entertainment Committee, had for many years been in charge of the entertainment programme. Mr. LeCompte had made all the preliminary entertainment arrangements, but was called away on the opening day by the mobilization order for the National Guard. Mr. LeCompte is assistant quartermaster of the Seventh Regiment, N. G. N. Y., his regiment being among the first to leave for the border.

Arthur Ritter, of the American Blower Co., was chosen chairman of the Manufacturers' and Salesmen's Entertainment Committee, to take the place of Mr. LeCompte, and, with Secretary J. Barton Garfield, successfully carried out the plans made.

Those who contributed to the entertainment fund included: National Radiator Co., Pierce, Butler & Pierce Mfg. Corporation, Gurney Heater Mfg. Co., United States Radiator Co., Jenkins Bros., Westinghouse Electric & Mfg. Co., Kewanee Boiler Co., H. B. Smith Co., Sprague Electric Works, American Radiator Co., American Blower Co., Richmond Radiator Co., Fowler & Wolfe Mfg. Co., Keasbey & Mattison Co., Johnson Service Co., Warren Webster & Co., Hoffman Specialty Co., H. W. Johns-Manville Co., Cutler-Hammer Co., Consolidated Engineering Co., Brogan & Co., Haynes Selling Co., Kanawha Mfg. Co. and Federal Radiator Co.

At a meeting of the "Old Guard," which is composed of past officers and directors of the National Association of Master Steam and Hot Water Fitters, held in the St. Charles, Wednesday evening, June 21, the following were present:

Past presidents: Charles A. Geoghegan, New York; P. Gormly, Norristown, Pa.; Stewart A. Jellett, Philadelphia; Alfred E. Kenrick, Brookline, Mass.; John T. Sadler, Elmira, N. Y.; Elias D. Smith, New York, and Past Director George H. Zellers, Washington, D. C.

Present officers: J. A. Almirall, New York; N. P. Bishop, New Haven, Conn.; John T. Bradley, St. Louis, Mo.; Frank G. Carthey, Salt Lake City, Utah; N. Loring Danforth, Buffalo, N. Y.; Edmund Grassler, Milwaukee, Wis.; William H. Oakes, Boston, Mass.; J. E. Rutzler, New York; Julius A. Ziesse, Grand Rapids, Mich.; Henry B. Gombers, New York, and John C. F. Trachsel, Philadelphia, Pa.

The "Old Guard," through Elias D. Smith, "captain of the Guard," sent a message of greetings to "Quartermaster Bill LeCompte" as follows: "The Old Guard of the National Association of Master Steam and Hot Water Fitters, convened at Atlantic City, send gretings to you in the enforced separation. We admire your patriotism, rejoice in your prompt response to the call of duty, deplore our loss and pray for your safety. 'We will meet, but we will miss you, very, very much."

The presence of over 100 ladies added greatly to the success of the convention. On Thursday they held an indoor golf tournament on the miniature course on the Garden Pier, A. S. Armagnac, J. Barton Garfield, R. B. Hunt and C. S. Wood directing the play. The prize winners were Mrs. J. E. Rutzler and Mrs. Charles A. Geoghegan. In the evening, under the direction of H. G. Issertell, the ladies were escorted to the Steel Pier, where dancing was indulged in, the party adjourning later to a midnight luncheon at the Isleworth.

Several local attractions, including a baby parade and a fancy float parade vied with the attractions that had been provided for the ladies, but all were on hand for the bowling tournament Friday evening. This event consisted of a team match between the manufacturers and contractors, a tournament for the ladies and an open tournament for members. Chairman Ritter and Captain Garfield were assisted in handling the various events by H. G. Issertell and Frank K. Chew. The Manufacturers and Salesmen won the team match, the winning players being C. A. Miller, Frank Martin, A. Ritter, W. M. Cosgrove and C. S. Wood. On the contractors' team were Messrs. Wenzel, Netz, Bower, Jones, Jellett and Danforth. W. H. Driscoll won the open tournament for members and the winning ladies, in order, were Mrs. Wenzel, Mrs. Netz, Mrs. Quilty, Mrs. Ritter, Mrs. Child, Miss Rutzler, Mrs. Sheldon, Mrs. R. Roberts, Mrs. Curtin, Miss Wallace and Mrs. Brogan.

After the contest the party returned to the St. Charles, and the retiring president, Mr. Bradley, presented the prizes, provoking much merriment through his efforts to influence the choices of the prizes by the winners.

Many expressions of regret were heard over the death of W. D. Weaver, who has for many years acted as official stenographer for the convention.

Though not strictly a part of the meeting, the tournament of the Eastern Trade Gold Association held June 21, at the Atlantic City Country Club, attracted many of those at the convention. Twenty-eight players competed for the silver cup presented by James D. Erskine, of the American Radiator Company, which was won, in a match against bogey, by Joseph Geoghegan, of New York. Other winners were W. F. Stearns, R. T. Potts, G. M. Scott, the president of the association; G. H. Chasmar and E. L. Bortner.

Among the Manufacturers.

The following were noticed among the manufacturers' representatives present:

Warren Webster & Co., Camden, N. J.: Warren Webster, E. Kessler Webster and E. K. Lanning, Camden; George Eagan, Philadelphia; L. H. Quackenboss, New York.

American Radiator Co., Chicago, Ill.: Charles K. Foster, Chicago; James D. Erskine, W. M. Cosgrove, J. Barnum, J. Barton Garfield, New York; W. F. Stearns, Boston; W. A. Blank, Philadelphia.

Jenkins Bros., New York: Frank Martin, New York, and J. D. Stiles, Boston.

Monash-Younker Co., Chicago, Ill.: Louis P. Monash.

American Blower Co., Detroit, Mich.: Arthur J. Ritter, New York.

H. B. Smith Co., Westfield, Mass.: C. A. Miller, New York; G. H. Chasmar, Washington; H. D. Kellogg, Thomas C. Brunt and William H. Jackson, Philadelphia.

Pierce, Butler & Pierce Mfg. Corporation, New York: E. F. Glore, J. J. Kelly, R. L. Leslie and Leon T. Fest, New York; E. H. Giles, R. S. Auffort and Paul Dewees, Philadelphia.

Sprague Electric Works, New York: H. G. Issertell.

Federal Radiator Co., New Castle, Pa.: George W. Barr.

M. E. Conran Co., Brooklyn, N. Y.: M. E. Conran.

Johnson Service Co., Milwaukee, Wis.: Frederic E. W. Beebe and Frank Shay, New York.

J. L. Mott Iron Works, New York: J. J. Blackmore.

United States Radiator Corporation, Detroit, Mich.: H. T. Cole and E. E. McNair, Detroit; C. P. Hackett, Philadelphia; A. H. Ross, New York.

J. D. Johnson Co., Brooklyn, N. Y.: William T. Gilmour.

Kewanee Boiler Co., Kewanee, Ill.: H. E. Purcell, salesmanager; Homer Addams, New York, and E. P. Bradley, St. Louis.

Hoffman Specialty Co., Chicago, Ill.: E. S. Storms, New York.

International Heater Co., Utica, N. Y.: President Frank B. Wheeler.

Molby Boiler Co., New York: E. C. Molby.

Kanawha Mfg. Co., Charleston, W. Va.; J. B. Bernhard, Charleston; J. F. Siegel, New York.

Penn Engineering Co., Philadelphia, Pa.: Harry Hellerman.

Greenfield Tap & Die Co., Greenfield, Mass.: Harvey S. Ashmun.

Keasbey & Mattison Co., Ambler, Pa.: C. S. Wood, Newark, N. J.

Richmond Radiator Co., New York: P. M. Beecher.

Speakman Supply & Pipe Co., Wilmington, Del.: Albert G. Weber and Joseph H. Dallett.

Vapor-Vacuum Heating Co., Philadelphia, Pa.; A. E. Kriebel.

Haynes Selling Co., Philadelphia, Pa.: C. F. Haynes.

Johnson Vapor Heating Co., Boston, Mass.: John M. Sewall.

Isaac A. Sheppard & Co., Philadelphia, Pa.: A. W. Proctor and H. K. Lodge.

Bishop-Babcock-Becker Co., Cleveland, Ohio: William W. Morgan, New York.

Bridgman Bros., Philadelphia, Pa.: Frank C. Eckfeldt, G. Wobensmith, H. H. Blake, Charles N. Moore and T. J. Sommers.

Brogan & Co., Philadelphia, Pa.: J. Brogan.

New Jersey State Association.

New officers were elected as follows at the annual meeting of the New Jersey Association of Master Steam and Hot Water Fitters, held in Newark, N. J., May 24; President, T. B. Cryer; vice-president, J. S. Boyce, Asbury Park; secretary-treasurer, Harry Geiser; directors: George Turner, Asbury Park; George S. Kappel, Camden, and Walter Lawson, Newark.

National Association of Master Plumbers.

David H. Roberts, of Cleveland, Ohio, was elected president of the National Association of Master Plumbers at its recent annual convention in Atlantic City. Mr. Roberts served last year as vice-president. Other officers elected were: Vice-president, L. McNamara, St. Louis; treasurer, William McCoach, Philadelphia. President Roberts appointed E. Ellen, of Cleveland, as secretary.

In the matter of the litigation against members of the association in Des Moines, Salt Lake City and Erie, President Cassedy, in his annual report, stated that "as yet no decision has been handed down by the Court of Appeals and we can only wait and hope that this court may arrive at a full and complete understanding of the real purposes of our association."

Nearly 1,000 members and guests were present.

Final Arrangements for Mid-Summer Meeting.

Due largely to the activities of the newly organized Michigan Chapter, a most attractive program has been arranged for the mid-summer meeting of the American Society of Heating and Ventilating Engineers, in Detroit, Mich., July 19-21. A special invitation is extended to the members to bring the ladies, elaborate arrangements having been made for their entertainment and comfort. Headquarters will be at the Hotel Statler.

Wednesday, July 19, will be taken up with registration and a session in the morning, a luncheon at noon in the room adjoining the convention hall (with a luncheon for the ladies at the Fellowcraft Club) and an afternoon session. In the evening there will be an informal dinner dance at the Fellowcraft Club.

Thursday, July 20, will be devoted to the trip to the University of Michigan, at Ann Arbor. There will be one session at the university and Professor John R. Allen, president of the Michigan Chapter, will show the delegates some interesting things in connection with the work of his testing laboratory. The Ann Arbor committee has arranged for an organ recital in the Hill Auditorium. The return trip to Detroit will be made at 5:30. In the evening there will be a moonlight dance on the steamer "Pleasure."

The final session will be held Friday morning, July 21, and the afternoon will be taken up with sight-seeing trips and visits to industrial plants in Detroit.

The papers to be presented will include the following:

"Heat Transmission Through Building

Materials," by Professor John R. Allen, recounting the results of his recent tests.

"Testing Hot Air Furnaces," by R. W. Davenport, mechanical engineer for the Detroit Stove Works.

"Heating a Conservatory and Greenhouse," by Professor J. D. Hoffman.

"Clean, Pure Air for Our Cities," describing the operation of a cinder collector on the top of a chimney in New York City.

"Ventilation of Garages," by C. W. Obert.

"Test of Sectional Valves," by J. A. Donnelly.

"Engineering and Cost Data Relative to the Installation of Steam Distributing Systems in a Large City," by F. H. Valentine.

In addition to the chapter reports, there will be an interesting committee report, Professor W. F. Vernon, chairman, on "Best Place in Room for Radiator."

Professor Ensweiler is preparing a paper on "Test of Velocity of Flow in Galvanized Ducts," which, it is hoped, will be ready in time for presentation at the meeting.

New Year Book.

A new year book of the heating engineers' society has been published, containing lists of members, officers and committees, as well as the society's charter, constitution and by-laws. There is also a list of past officers, calendar of past meetings and a list of the papers read before the society. The new arrangement adds greatly to the convenient use of the year book which was published under the direction of Secretary C. W. Obert.

This list of members, corrected to April 1, 1916, now totals 705, including all grades.

Organization of Ohio Steam Heating Association.

A new organization in the heating trade has been formed in Ohio by some fifty contractors and manufacturers' representatives, with the purpose of developing a state-wide plan of publicity, by means of newspaper advertising and personal solicitation among city, county and state officers, in the interests of steam and hot water heating. The members are agreed that there is urgent need of acquainting prospective builders with the advantages of steam and hot water heating.

The organization will be unique in having no affiliation with any other body, either state or national. It is also announced that it will have nothing to do with labor matters and will not attempt to arrange prices. The object of the association, as stated in its constitution, is "to further the interests of steam and hot water heating of public and private buildings of all types, and to educate school boards and building committees of state, county and city of public and private buildings to the use of steam and hot water for heating purposes, and to secure just and meritorious legislation covering the use of steam and hot water for heating purposes and sanctioning the use of direct-indirect radiation in all public and private buildings."

The officers of the association, elected at the organization meeting, held in Columbus, June 6, are: President, Frank H. Field, Columbus representative of the McGinnis Co., Pittsburgh; first vice-president, W. H. Conklin, of W. H. Conklin Co., Columbus; second vice-president, J. W. Bryce, Springfield; secretary-treasurer, A. W. Miller, Columbus representative of the Peerless Heating Co., of Pittsburgh. Mr. Miller will also act as the association's business manager. The members of the executive committee are: E. H. Hannaford, Peck, Anderson & Peck, Cincinnati; D. J. Sweeney, Urbana; W. J. Schall, Youngstown; J. F. Bartholomew, of Bartholomew Bros., Zanesville, and O. J. Wheeler, of the Esswein Co., Columbus. General direction of publicity will be in the hands of President Fields and Secretary Miller.

The permanent headquarters of the association will be in Columbus. Active members will pay $50 a year dues and associate members, $40 per year. The educational nature of the organization is indicated in the announcement that an early meeting will be devoted to technical papers and discussion.

Sidewalk Ventilation Gratings on Broadway, New York, Barred.

The long fight waged by Broadway business and real estate men to prevent the use of sidewalk ventilation gratings in connection with the New York subway was partially won recently when the Public Service Commission, on recommendation of Henry W. Hodge, voted to eliminate these gratings in the new subways along Broadway between Twenty-ninth and Thirty-fifth streets and between Thirty-ninth and Forty-sixth streets. The gratings between Thirty-fifth and Thirty-ninth streets will have to remain, as it is impossible to replace them on account of the long distances to the nearest ventilating chamber.

In place of the sidewalk gratings, Commissioner Hodge has recommended the installation of ventilating chambers at three points between Twenty-ninth and Forty-sixth streets. One chamber will be in Greeley Square under the elevated structure there and erected on a "safety isle"

to be built between the tracks. Another chamber will be placed behind the Dodge statue in Herald Square and the third in the triangle just south of the junction of Seventh avenue and Broadway.

In his report Commissioner Hodge said:

"While the regulation of air currents in this subway is not, in my opinion, capable of absolute control, owing to the uncertainties of the piston action of trains in opposite directions, the openings in the division walls, the station entrances, emergency exit openings and other factors which prevent exact mathematical calculation, yet I am of the opinion that by introducing fans and a ventilating duct near Forty-second street and similar fans and a ventilating duct near Thirty-first street, the portions of the subway between Twenty-ninth street and Thirty-fifth street, and between Thirty-ninth and Forty-sixth streets can be properly ventilated without sidewalk gratings.

"While I am of the opinion that the two fan outfits and these gratings in open spaces will properly ventilate these portions of the subway, I feel that it will be safest to preserve the present ventilating chambers between Thirty-ninth and Thirty-second streets, so that, in case the ducts do not give satisfactory ventilation, gratings can be restored over these vent chambers, as also over the openings above the station between Thirty-ninth and Forty-second streets.

CORRESPONDENCE

The Danger of Excessive Humidity in the Air Supply.

Editor HEATING AND VENTILATING MAGAZINE:

From our work in air washing and humidifying lines we have come to the conclusion that much higher humidities are being specified than are advisable. Practically all of the reports that we have studied covering the work of investigators on heating and ventilating and air conditioning show that in an auditorium that is to be occupied by a large number of people there is never a lack of proper humidity and almost always a state of excessive humidity. The vapor given off by the bodies of the occupants soon brings about a condition of relative humidity much higher than need be or advisable, with the result that the feeling of discomfort is more easily produced because the wet bulb temperature rises, making the evaporation from the skin less rapid, with a consequent tendency to increase the skin temperature, thereby causing discomfort.

It seems quite contradictory to send tubercular patients to the mountain altitudes and to localities of very low humidity and at the same time to insist upon children being kept in schoolrooms for several hours a day with air supplied at humidities of 50% at 70° F. which frequently results in humidities maintained in the room higher than 70%.

F. R. ELLIS.

Boston, Mass.

COMMENTS OF DR. THOMAS R. CROWDER, DIRECTOR OF THE DEPARTMENT OF SANITATION AND SURGERY OF THE PULLMAN COMPANY.

It is commonly asserted that dry air is harmful. The truth of this statement has not been proven, although much engineering practice has been based on the assumption of its truth. It is a matter of common experience that many of the elaborate devices for conditioning air have failed of their purpose to create comfort in spite of their ability to maintain the desired degree of humidity.

About all the exact knowledge we have concerning the physiological effects of humidity is that much moisture in the air is harmful. This is certainly true when temperatures are high; whether it holds through the lower thermic scales has not been clearly shown. Rubner, one of the greatest of hygienists, makes the statement that the body does best in an atmosphere of low humidity.

It is almost beyond question that the effects of air on the body are to be explained wholly on the basis of thermic relations. Humidity is one of the three elements controlling the thermic effect of air on the body, the other two being temperature and motion. Within certain limits, varying any one of these qualities can be entirely compensated for by changing the other two. So it would not seem that any absolute standard either of humidity, or temperature, or motion, is possible. Neither is it possible, in my opinion, to establish an absolute standard of combined humidity, temperature and motion, for the simple reason that perfect uniformity of atmospheric conditions is not desirable. The constant stimulation of the skin which is induced by constantly varying its atmospheric environment contributes both to comfort and to healthy physiologic responses.

It is not probable that the alleged drying effect on the mucous membranes of air with low humidity is real, but that the effects so ascribed are rather due to too high a tem-

perature, or to such a combination of temperature, motion and humidity as fail to accomplish a normal amount of heat elimination from the body and so break the thermic balance on which a proper distribution of blood depends. We do not get this drying effect from breathing cold air, although cold air contains very little moisture and takes up much from the lungs. The amount of water vapor given up by the mucous membranes of the respiratory tract to the air passing over them depends on the absolute amount of moisture in the air and not on its relative proportion. Whether the air is taken in cold or warm, it comes out essentially at the temperature of the body and essentially saturated with water vapor. Thus in the winter time we give up the same amount of moisture with each breath whether we are breathing the outside air at a temperature below freezing or the same air after it has been brought inside and warmed to 70° F. This is a fact which seems to have been quite lost sight of in the discussion of humidity.

VIEW OF DR. M. J. ROSENAU, DEPARTMENT OF PREVENTIVE MEDICINE AND HYGIENE, HARVARD UNIVERSITY MEDICAL SCHOOL.

There is no doubt that excessive heat and humidity are injurious to health and decrease efficiency, but the subject is still too young to make any statement with finality. There are factors still not understood.

Cost of Removing and Replacing Pavements.

Editor HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for May there appears an article by W. F. Verner on the cost of removing and replacing pavements incident to installing heating lines in city streets.

Do you understand that the table appended to the article applies to New York City conditions? I assume that it does, on account of the wages of the men and the cost per lineal foot, which agree very closely with prices and costs in New York City, but, so far as I know, there is no other place in the United States where the costs are so high as they are here. If they are as high elsewhere, I should be very glad to know of it. CHARLES N. GREEN.

New York, N. Y.

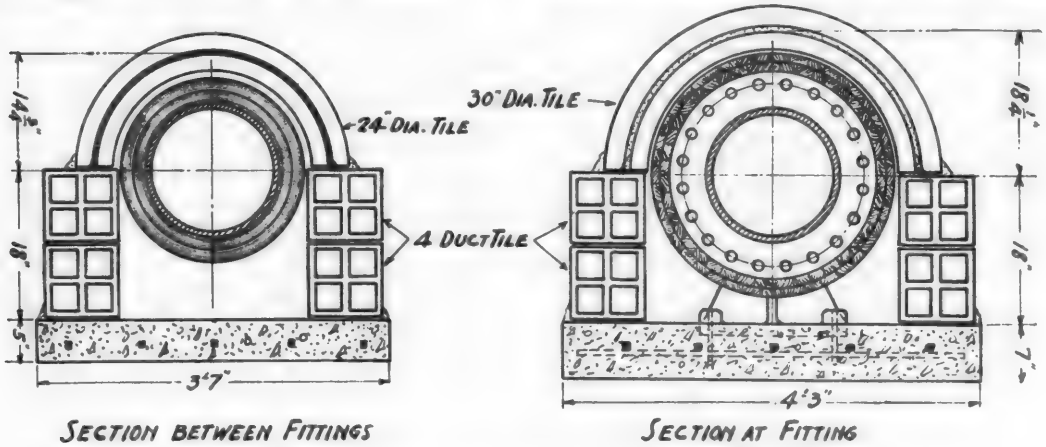
REPLY BY W. F. VERNER.

The unit prices for labor and materials given in my paper on "The Cost of Removing and Replacing Pavements" are those paid by public utility companies to the Department of Public Works of Detroit, Mich., during the early part of 1915. The department does all repaving and bills the companies for the cost of same.

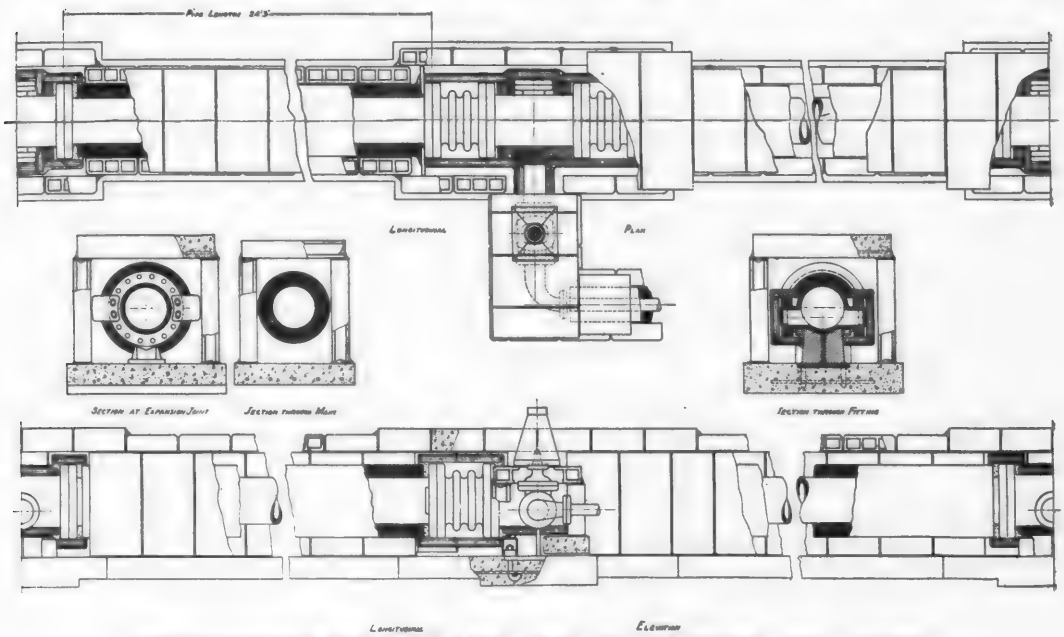
The time and material quantities are averages of several years' construction, most of which was done in the business district of Detroit.

Important Extension of Central Station Steam Service in New York.

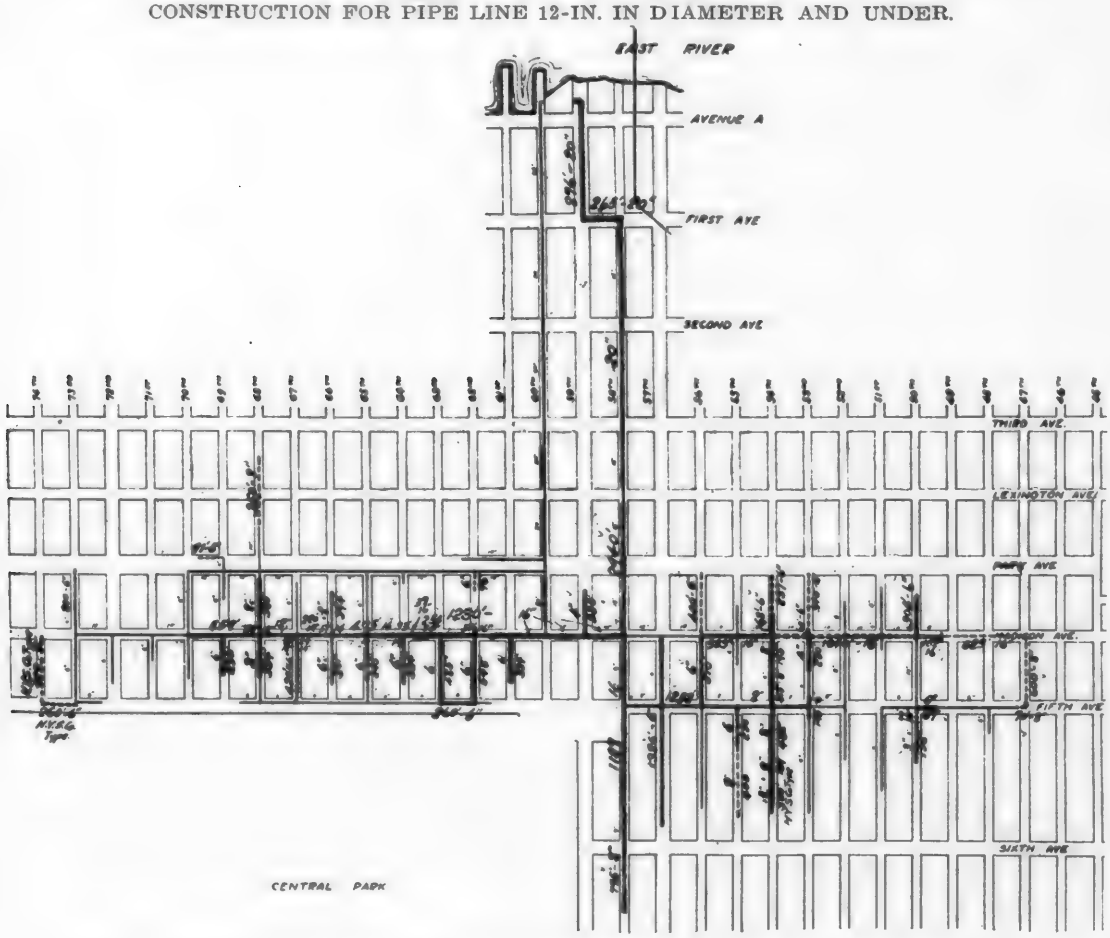
Plans for the extension of the service of the New York Steam Company in both the downtown and uptown districts of New York City, involving a total outlay of over $1,000,000, are now being carried out. The work covers a three-year programme and includes the relaying of 30,000 ft. of underground conduits on the order of the New York Public Service Commission. This relay work alone will cost approximately $500,000. The commission has charge of the construction of the New York Subway extensions and many of the steam company's mains are close to the subway excavations.



CONSTRUCTION FOR 14-IN. AND 16-IN. MAINS, NEW YORK STEAM COMPANY.

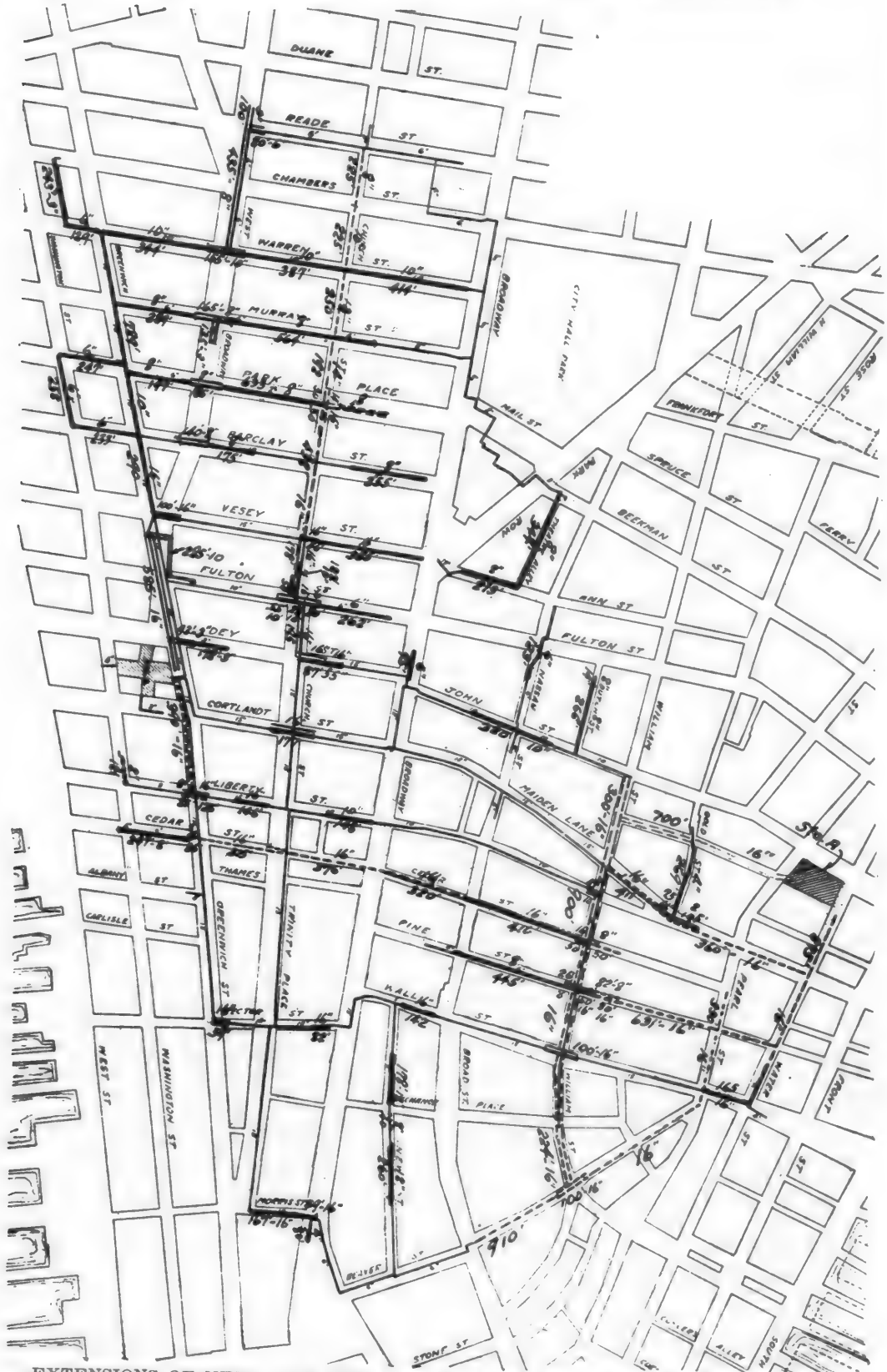


CONSTRUCTION FOR PIPE LINE 12-IN. IN DIAMETER AND UNDER.



MAP OF EXTENSIONS OF NEW YORK STEAM COMPANY'S SYSTEM IN DISTRICT J. NEW YORK.

Heavy lines—new mains. Dotted lines—extensions.

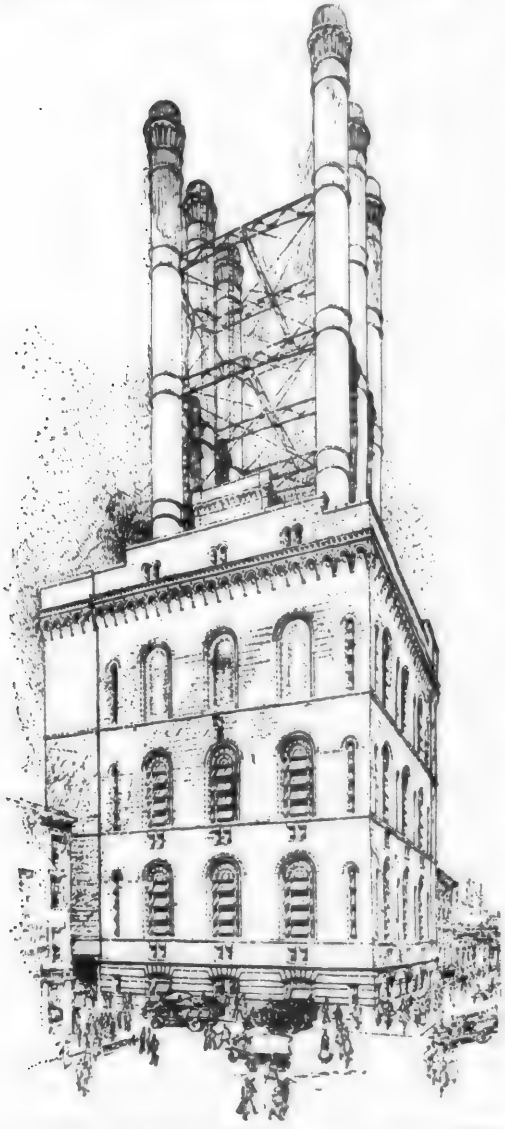


EXTENSIONS OF NEW YORK STEAM COMPANY'S SYSTEM IN THE DOWNTOWN DISTRICT.

Heavy lines—new mains. Dotted lines—extensions. Full heavy lines—commission order. Full double lines—subway work.

With the old type of insulation, some of which had been in the ground 20 years or more, it was feared that the leakage of heat from the steam pipes would damage the waterproofing of the subway.

The commission's order fell in with the company's plans for extensive changes in its system to bring it up to a proper state of efficiency and service. These plans were thereupon matured and, under the company's new management, are being actively pushed. They include the construction of a $1,500,000 power house at Burling Slip and Water Street, which will be devoted exclusively to the generation of high-pressure steam for operating power and heating equipments in the Wall Street district. The new power house will have a capacity of 20,000 H. P., and as soon as it is ready for operation, probably some time in October, 1916, the company will proceed to rehabilitate its present 18,000 H. P. plant on Dey Street.



NEW POWER HOUSE OF THE NEW YORK STEAM COMPANY AT WATER ST. AND BURLING SLIP, NEW YORK.

An interesting feature of the new power house in Burling Slip is that it is equipped with Cox stokers for burning anthracite coal. This and other features, when compared with the company's plant on Dey Street, afford an interesting commentary on the progress of modern power plant practice. The new building is 150 ft. in height and the total height to the top of the smoke stacks is 310 feet.

Fully 80% of the company's present street lines will ultimately be rebuilt, while the proposed extensions amount to approximately 20,000 ft. in the downtown district and 15,000 ft. uptown. The old construction of standard pressure fittings and screwed pipe is being replaced throughout by extra heavy fittings and welded flange pipe. The accompanying illustrations include views of the new types of conduit adopted, Fig. 2 showing the construction for pipe lines 16 in. in diameter and Fig. 3 showing the multicell construction used for lines of smaller diameter.

The extensions in the uptown district are equally important. In the company's 59th Street station on the East River (Station J), additional boilers are being installed in an annex to the power house and the entire boiler equipment is being converted from hand-fire to soft coal stokers. When completed, this plant will have a total of 36,700 H. P., the former horsepower being 20,000.

A general idea of the extensions of the company's lines is given in the accompanying maps. This work, as well as the construction of the new power house and the extension of Station J, is being carried out by a separate company formed for the purpose and called the Burling Engineering & Construction Co., with offices in the same building as that now occupied by the New York Steam Company, at 280 Madison Avenue. Each company occupies an entire floor in this building and the quarters have been handsomely fitted up on a scale indicating the company's increased activities.

The developments here described followed extensive changes in the management of the company last year when large Western financial interests came into control. Among the new officers, representing the interests referred to, are A. E. Duram, who was chosen president, succeeding G. C.

St. John; and C. A. Gillham, chosen vice-president, succeeding C. C. Upham. These new officers were both formerly identified with the Central Station Engineering Co., of Chicago, and later with the American District Steam Co., of North Tonawanda.

The full list of officers of the New York Steam Company is: President, A. E. Duram; vice-president, C. A. Gillham; secretary-treasurer, George S. Beith. Board of directors: A. E. Duram, C. A. Gillham, George S. Beith, Karl R. Miner, Sidney S. Wilson, A. H. Van Gorder, F. E. Pendleton, W. J. Baldwin, Jr., and A. E. Smith.

The Burling Engineering & Construction Company is organized as follows: President, T. P. Pinckard; vice-presidents, H. A. Austin and H. O. Greist; treasurer, Kenneth Stevenson; secretary, H. R. Brown.

Taking Cinders and Dust from the Gases in Chimneys.

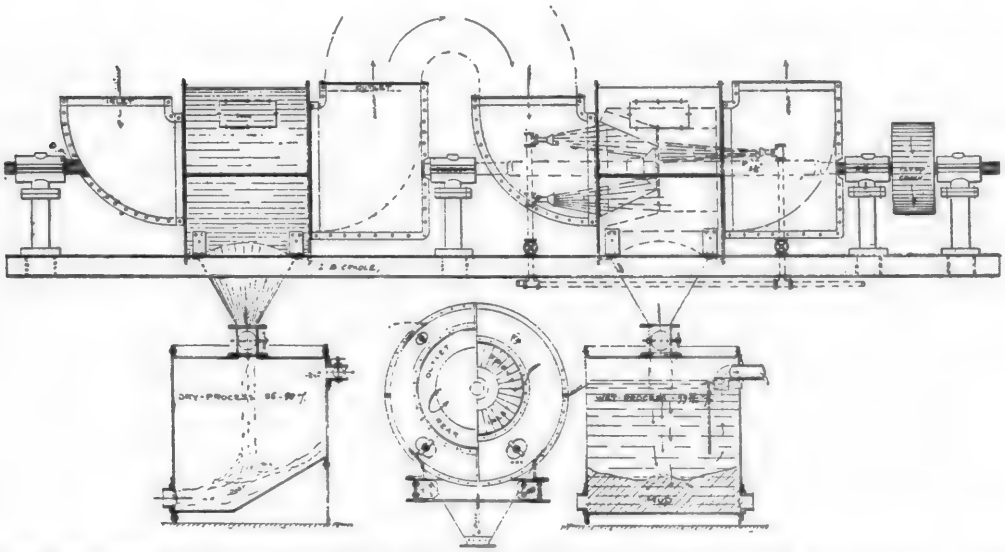
A dry method of preventing dust and cinders from being carried out of the tops of chimneys, in which use is made of centrifugal force to separate the dust from the smoke, was described by William J. Baldwin recently before the Brooklyn Engineers' Club. The apparatus was designed by Mr. Baldwin and emphasis is laid on the point that it should not be confounded with smoke prevention apparatus, nor is it designed to compete with ventilating devices or humidifiers, although the apparatus may be adapted to a variety of uses.

While performing its stated functions the apparatus is also designed to accelerate the chimney draft, when desired, and to help balance the draft.

Dust and cinder prevention have been accomplished with some success by the use of water, but too much water cools the chimney gases and destroys the draft, as well as eats away the iron flue connections and the dampers. A "rain" of water has been showered upon an apron in a closed chamber, successfully removing the cinders and dust, but the acids that form with the use of the water shower are likely to eat away the iron smoke breechings. Also, sulphuric and other acids condensed from the chimney gases will attack even cement chambers and the chimney linings.

In the design of a dry method, advantage was taken of the fact that dust will leave the air by gravity under favorable conditions. To make such an idea practicable in a machine occupying a small space, it became necessary to make centrifugal force take the place of centrifugal force. In this way the dust and cinders are forced into a closed box, but without allowing the air to follow the dust. As the dust is thrown out over a full circle of 360 degrees, it was necessary to make the dust box an annulus. It was found that when the dust was thrown through a perforated band on the inner side of the annular box, the particles would remain in the box and fall to the lower side and thence to any desirable place of disposal lower than the box.

It was also found that when the annular box revolved, the particles thrown



24-IN. TANDEM SEPARATOR DESIGNED BY WILLIAM J. BALDWIN FOR SEPARATING CINDER AND DUST FROM SMOKE.
Speed—1,150 r. p. m. Quantity—10,000 cu. ft. min. Power—20 h. p.

against its inner and perforated surface received an additional impetus and that they could not return again to the source. The box was, therefore, designed to be revolved. With this arrangement dust particles striking the box with a velocity or outward force of 100 while in the gas, receive a velocity of about 150 when they touch the perforated rotor, so that there is not only the initial projecting force to throw the particles against the screen, but an added force to keep them from returning. Once outside the perforated band, the cinders in the gas come under the influence of gravitation and fall away.

While the cinder and dust pass through the perforated band, the air or gas will not, because the outer case is closed. The perforated screen is in the path of the high velocity gases against which the air or gas strikes and changes its course, the dust particles doing the same to some extent, the effect being to give the gases an additional impulse. In actual operation some of the particles pass directly through the perforation and some lodge against the solid part of the screen, but these are forced through the next opening by the deflected air or gas.

With this machine it has been found possible to take out as much as 90 to 95% of ordinary chimney dust dry, and if water is used in the machine practically all of the dust can be removed. The machines are intended to be located between the powerhouse boilers and the chimney.

In discussing the general subject of cinder removal, Mr. Baldwin called attention to the fact that at the present time, when it is so common to run boilers at 300% or more of their rated capacity in the busy hours, it is a greater necessity than ever to intercept that part of the dust and cinders that now go up the chimney. He also pointed out that the average factory boiler chimney will take care of, say, 500 H. P. and a power house chimney may take care of 50,000 to 100,000 H. P., so that there is from 100 to 200 times as much dust per unit of area of roof or street, from the power house as from the factory chimney.

More Publicity for Warm Air Furnaces.

Renewed efforts to extend the use of warm air furnaces were decided upon at the recent meeting of the National Warm Heating and Ventilating Association, which was held in Cleveland, June 6. President John D. Green of Detroit was re-elected, as were the other officers, including Vice-President F. T. Giblin, Utica, N. Y.; Treasurer W. G. Wise, Akron, O., and Secretary Allen W. Williams, Columbus, O. The executive committee for the coming year will be composed of John A. Howard, Dowagiac, Mich., E. P. Miller, Marshalltown, Ia., and Charles Seelbach, Cleveland, O.

In connection with the publicity campaign, it was voted to authorize a committee to collect and expend a fund for advertising on a basis of double the apportionment of last year. This would give about $50,000 to be expended in the coming year. Last year the money was devoted largely to advertising in the general magazines.

The assoiation has a membership of 56 concerns, representing, acording to President Green, 80% of the total output of warm air furnaces in the United States.

Secretary Williams, in his report, presented some interesting trade statistics showing generally that there has been an increase during the past year in the warm air furnace industry, that the cost of goods used by the manufacturers has not changed appreciably during that time and that the cost of distribution is, if anything, a little less than it was last year. The trade prospects were generally considered to be good, although some reported "fair," but none "poor."

Professor Kenneth G. Smith, of the Iowa State College, addressed the meeting on "College Courses in Warm Air Heating and Engineering," giving details of the course on this subject at the Iowa State College. Frank K. Chew, of New York, also spoke on "Heating Low-Cost Houses."

Current Heating and Ventilating Literature.

(Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on reeipt of the stated price.)*

INSTITUTION PLANTS—

Design of a Power Plant for an Institution. Charles L. Hubbard. Ills. 2200 w. N E—April, 1916. Serial, 1st part. Essential steps. 20c.

SCHOOL PLANTS—

The School Power Plant. Harold L. Alt. Ills. 2500 w. Bkbld—April, 1916. Practical examples. 40c.

VENTILATION—

Ventilation Requirements and Test Methods. E. V. Hill, with discussion. Ills.

25 pp. W S E Jl—Feb., 1916. Good practice and methods. 40c.

Indirect Heating and Ventilation. Edward H. Kearny. 5000 w. N E—April, 1916. Various systems. 20c.

Papers Published by New York State Commission on Ventilation.

In addition to reports on the work of the New York State Commission on Ventilation which have been presented before the American Society of Heating and Ventilating Engineers, the commission has recently published the following papers in the form of reprints of articles dealing with the activities of the commission:

"The Action of Temperature and Humidity on the Working Power of Muscles and on the Sugar of the Blood," by Frederic S. Lee and Ernest L. Scott (American Journal of Physiology, May, 1916).

"The Kata Thermometer as a Measure of the Effect of Atmospheric Conditions Upon Bodily Comfort." by C.-E. A. Winslow (Science, May 19, 1916). (A detailed description of the construction and use of the Kata thermometer was published in THE HEATING AND VENTILATING MAGAZINE for September, 1915.)

"The Effect of Changes in Atmospheric Conditions Upon the Upper Respiratory Tract," by James Alexander Miller and G. H. Cocks (Transactions of the American Climatological and Clinical Association, 1915).

"A New Sampling Apparatus for the Determination of Aerial Dust," by George T. Palmer (American Journal of Public Health, January, 1916).

Simple Directions for Measuring Humidity.

To measure humidity is not difficult. Everyone knows that evaporation takes heat or causes a cooling of the surface from which evaporation takes place. The cooling of the face by bay rum after a shave is a familiar example. The more rapid the evaporation, the greater the cooling effect. Naturally, dry air will evaporate water more rapidly than moist air, just as a dry sponge soaks up water more rapidly than a wet sponge.

We make use of this principle in measuring humidity as follows: Take this ordinary mercury thermometer and read the temperature of the room. Whirl it about on the end of a string so as to get a good average temperature. Note that this temperature, known in measuring humidity as the dry bulb temperature, is simply the room temperature.

Now let us wrap a piece of porous muslin about the bulb and wet it with water. The temperature drops at once, due to the fact that the water is evaporating. The drier the air, the faster and farther the temperature will drop. Swing the thermometer about on the end of the string so as to produce a current of air about the bulb. The temperature continues to fall but becomes stationary after a little time. This final temperature is known as the wet bulb temperature.

The difference between the wet and dry bulb temperatures is a measure of the relative humidity. The greater the difference between the two at a given temperature, the drier the air. We could calculate the relative humidity if we desired, but the practical man uses a humidity table, obtainable in the catalogues of companies manufacturing air conditioning apparatus. This simply says that for a difference of so many degrees at a given temperature the humidity is so much in per cent. Instruments, known as sling psychrometers, are used for very accurate work, but with a common thermometer used as I have shown you can obtain very fair results.

The dry bulb or room temperature, we will say, is 71° F. This thermometer, now used as a wet bulb thermometer, reads 57°. The difference is 14°. According to this table, a difference of 14° at a temperature of 71° indicates a relative humidity of 41%.

KENNETH G. SMITH.

THE BUSINESS OUTLOOK.

VI.

By FRANK M. HUSTON.

Financial Editor of the Chicago Evening Post; Editor Rand-McNally Bankers' Monthly.

Business is forging ahead in a remarkable way. Monthly statistics relating to the volume of bank exchanges at the leading centers of the country give ample evidence of an unprecedented activity in the business world, and this applies with equal force to practically every section of the United States. According to the last available statistics, clearings show an increase over the preceding year of approximately 35.2%, and in excess of 50% over two years ago, when computed on daily averages.

There is nothing that reflects immediate improvement in the business situation, or the reverse, so quickly as bank clearings, because they represent the exchange of instruments of credit passing between banks and, when analyzed for the country at large, they reflect fairly accurately the general trend in a period of time.

The greatest menace to this country has been the excess of money, for it afforded opportunities and encouragement to more or less wild speculation. Bankers all over the country, however, have been pursuing a conservative course. They have learned important lessons from experiences in the past and have frowned on those projects that were largely speculative in their character, being fully aware that any sudden outburst of speculation was certain to be followed by an equally violent reaction.

With this in mind, and realizing that the tremendous expansion of business along legitimate lines would require an immense amount of credit, the bankers have sought to avoid the pitfalls of the past by keeping their institutions as liquid as possible, even sacrificing earnings to do this, and the wisdom of their policy is now bringing results.

One of the most reassuring features of the present situation is the widespread employment of labor. From all parts of the country comes a report of a scarcity of labor, and this means better wages, steadier employment, greater opportunities for savings and the accumulation of capital in the hands of the small business man, a thing which contributes more to general prosperity because it affords a wider and better distribution of increased buying power and helps the small merchant or retailer as well as the manufacturer.

(Copyright 1916, Kovnat.)

New Book.

PRACTICAL SHEET METAL DUCT CONSTRUCTION, a treatise on the construction and erection of heating and ventilating ducts, by William Neubecker, has been published by *Sheet Metal*, New York. This book, it is stated, is the only one treating on construction and erection work of this character. It is an exceedingly practical manual, the text being explicit to a generous degree, while the illustrations are copious and show every important step taken in the construction of ducts, register boxes, casings for indirect radiators, ventilators, etc. The book sells for $2.00 and may be obtained through the book department of THE HEATING AND VENTILATING MAGAZINE.

No Summer Meeting for British Heating Engineers.

Announcement is made by the Institution of Heating and Ventilating Engineers that, owing to prevailing conditions in England at the present time, there will not be a summer meeting of the institution this year.

Application of the Steamo Air Moistener.

The accompanying illustrations, showing two general applications of the Steamo air moistener, will be of interest to those who desire to humidify by the use of steam.

Two sizes are made for application to radiators, taking steam directly from the radiator as long as the steam is turned on. This style is much used, but it is obvious that the preferable way is to take steam from the system outside of the radiator valve, so that humidification may be independent of heating. For this purpose two styles, shown in the illustrations, are more generally used.

In many cases vertical steam risers are particularly accessible; this is especially true of office buildings. In such cases the type shown in Fig. 1 is used. It connects

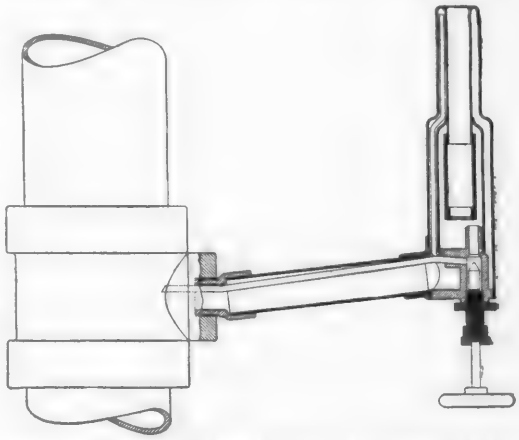


FIG. 1.—SECTIONAL VIEW OF RISER TYPE STEAMO AIR MOISTENER.

with the riser by a stem having either a ⅜-in. or ½-in. pipe thread. On new work, where tees are set in the riser for the purpose, the ½-in. connection is used, but on old work, where it is necessary to tap the riser, the ⅜-in. size is generally used, on account of its finer thread.

Fig. 1 shows this type in section as it screws into the tee of the riser. The air moistener proper is entirely surrounded by a steam jacket designed to prevent condensation, and to keep the silencer dry, so that no water will be discharged, and so that the device will work without noise. The stem of the moistener, which connects to the riser, besides holding the device in place, acts only as a supply for steam to and as a return for condensation from the jacket. In other respects the stem and the jacket are independent of the air moistener proper. The stem, being of ample size and pitch, allows a free return of the condensation when it is screwed directly

into the riser. If, however, any intervening fittings are employed, they are sure to prevent a return of the condensation, with the result that the jacket will get cold, and the moistener will not work properly.

As shown, a small pipe along the top of the stem extends well into the riser, where the steam is sure to be dry, and where it is out of the way of interference with the condensation return from the jacket. This pipe connects with the hand valve shown at the base of the moistener. The valve is set at the amount of opening required to insure the desired steam supply.

The steam from the riser by way of the small pipe and control valve passes upward and discharges into the closed silencer jacket, surrounding the silencer, through the sides of which it penetrates to the central outlet passage and thence upward to the atmosphere. The surrounding steam jacket is readily identified as the outer casing.

The radiator moisteners are just the same in principle as the r iser type except that the connecting stem is much shorter and the screw connection of the No. 1 is ⅛-in. and the No. 2 is ¼-in. pipe thread.

In those cases where the riser type is not suited to the situation, the single pipe type is usually employed, being often connected as shown by Figs. 2 and 3. Fig. 2 is an end view showing the moistener connected to the branch outside of the radiator valve by a bent pipe, although it may be made by using 45 degree ells. Fig. 3 is a front view of the same form of connection. Any other form of connection may be used as long as it conforms to the following requirements: Never use pipe or fittings of a size smaller than that which the Steamo is tapped for. Always take steam from the top of the branch, never from the bottom or side. Provide plenty of pitch so that the condensation may return against the flowing steam. Do not use long, horizontal connections.

The manufacturer is the Air Moistener Co., Chicago, Ill.

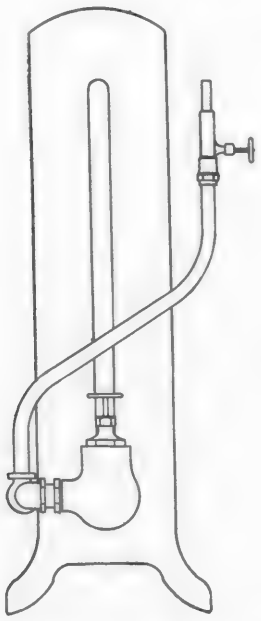


FIG. 2.—SINGLE-PIPE TYPE MOISTENER.

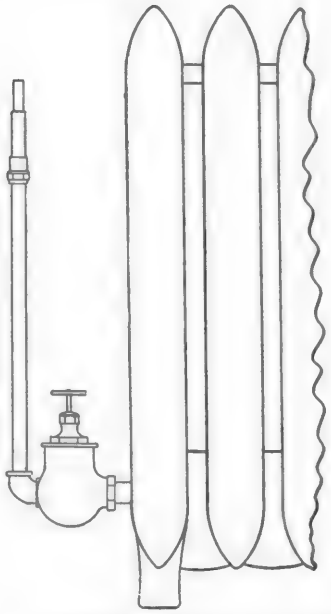


FIG. 3.—ANOTHER ARRANGEMENT OF SINGLE-PIPE TYPE MOISTENER.

A New Return Line Heating Pump.

An interesting development in vacuum pumps for return line work has been made by the Nash Engineering Co., South Norwalk, Conn. The pump is a turbine proposition, running direct-connected to standard-speed electric motor. It is furnished in five sizes, suitable for handling from 3,000 to 6.500 sq. ft. of direct radiation or its equivalent, and special units are supplied to take care of the largest heating systems.

The pump is really two pumps in one, a hydro-turbine vacuum pump, and a centrifugal water pump, both contained in one casing, the impellers of each pump are on the same shaft which is supported on highest grade annular ball bearings, mounted outside of the casing. Figs. 1 and 2 show the interior construction. The air impeller (Fig. 1) is at 14 and the water impeller at 20. Section B-B is taken through

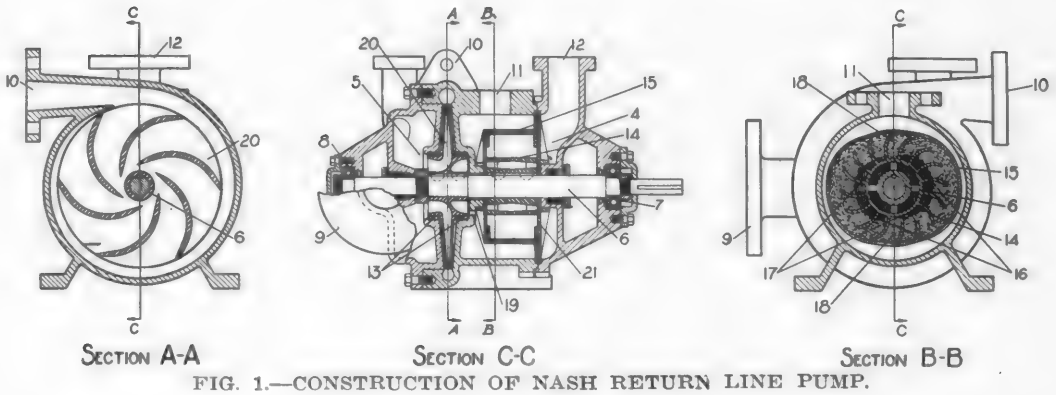


FIG. 1.—CONSTRUCTION OF NASH RETURN LINE PUMP.

the air end, and Section A-A through the centrifugal or water end.

Fig. 3 shows the arrangement of the piping. The water end of the pump is connected to the bottom of the separating tank C by the Pipe D. The air end of the pump is connected to the top of the separating tank by the pipe G. The returns come through the pipe A and the strainer B. The water is delivered through the Pipe F, direct to the boiler. The air outlet is connected to a vent by the Pipe H. A separator I is installed in this line to enable the water used for priming the air pump to be returned to the system.

Unlike other return line pumps, the water is separated before reaching the pump. This arrangement makes it possible to relieve four-fifths of the volume handled of back pressure, as the water only is delivered against the boiler pressure. The water is handled in a pump designed for water, and the air in a pump designed for air, which, it is stated, makes a higher efficiency possible than where the water and air are handled together.

For the reasons given and because of the design and workmanship, these pumps, it is claimed, require approximately one-half the horse power usually necessary for this work. Also the water end is so designed that it unloads when not handling water. In other words, the power is proportional to the condensation returned.

The air end of the pump works on a simple and ingenious principle. This part of the pump is a development of the well-known Nash hydro-turbine air compressor and vacuum pump, which has been made by the Nash Engineering Company for about seven years. Referring to the cross-section B-B, Fig. 1, the impeller 14 revolves freely in an elliptical casing 15, carrying water around with it. The water, following the casing due to centrifugal force, alternately recedes from and surges back into the impeller, twice in a revolution. As the water leaves the impeller it draws air in through ports 16 cut in the side of the casing. As soon as the blades of the impeller (now filled with air) pass the inlet ports, the air is trapped. The re-entering water now com-

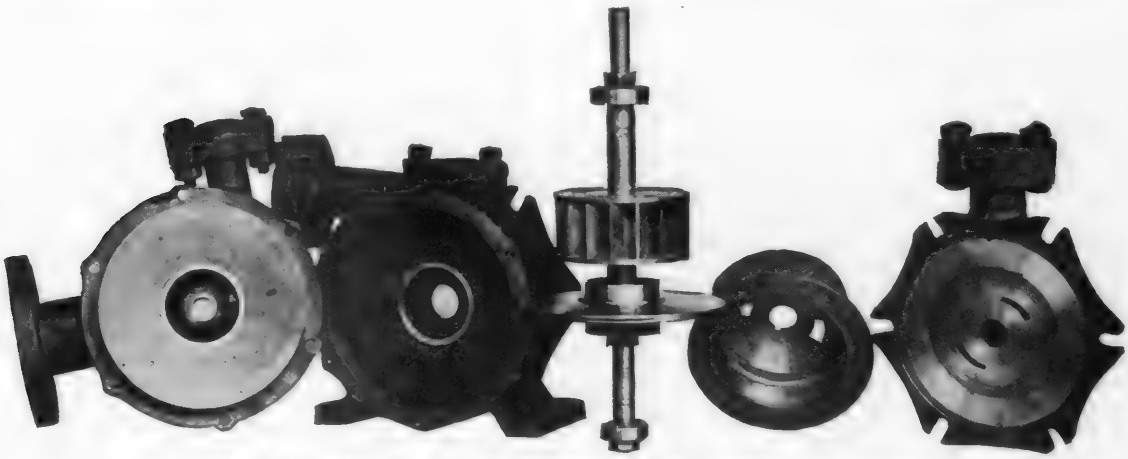


FIG. 2.—PARTS OF NASH PUMP READY FOR ASSEMBLING.

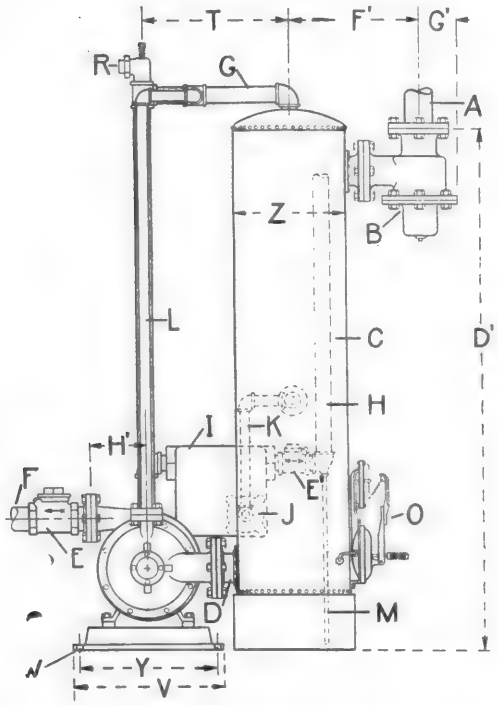


FIG 3.—PIPING CONNECTIONS TO SEPARATING TANK, PUMP AND BOILER.

A—Return riser. C—Separating tank. D—Centrifugal end of pump. F—Pipe to boiler.

presses the air and delivers it through outlet ports 17 (shown dotted because they are located in the head plate and therefore do not belong to section B-B).

As the peripheral clearance between the casing and the impeller is never less than $\frac{1}{32}$ in., and the shaft is supported on large ball bearings (which are practically free from wear), the pump can maintain its original high efficiency indefinitely.

All valves, gears, loose blades or reciprocating parts have been eliminated, and there are no bearing adjustments to be made. The pump, it is stated, requires practically no attention in service, except two or three times in a season when the ball bearings are supplied with lubricant.

Trade Literature.

Minneapolis Heat Regulators, described as the heart of the heating plant, are the subject of the latest (31st) annual catalogue of the Minneapolis Heat Regulator Co., Minneapolis, Minn. Prominent place in the catalogue is given to Model 47 one-day clock thermostat, which, when set, will change the indicator at any pre-determined hour, enabling one to have the rooms cool at night, with a resumption of the day temperature at the hour indicated. Another model (55) has an eight-day automatic time adjustment. The illustrations include views of the direct-current and alternating current motors used with this device. Size 6 x 9 in. (standard). Pp. 16.

Arco Temperature Regulation and Ideal Sylphon Heat Regulators are the subject of two recent circulars issued by the American Radiator Co., Chicago, Ill. In the Arco device the motor is spring-operated, one winding being sufficient for 60 to 75 operations. A winding indicator on the front of the motor shows the condition of the spring. They are made with one-day and eight-day clock attachments. The Sylphon devices all make use of the well-known Sylphon brass bellows. When used for air and water temperature regulation, it contains a liquid which, when heated, gives off a vapor like steam and has a powerful expansive force. The heating control is caused by the expansion and contraction of the bellows. Sylphon construction is used in the company's line of packless valves, regitherms, steam regulators, vapor regulators, water and tank regulators. Size of catalogues, 3½ x 6¼ in. Pp. 14 and 32, respectively.

Molby Down Draft Boilers is the title of a newly issued catalogue published by the Molby Boiler Co., New York, and calling attention to the fact that the company has completed an entirely new equipment for the manufacture of these boilers, including patterns, flasks and shop equipment and is prepared to turn out boilers promptly. The important features of the Molby boiler are then taken up in detail and numerous hints are given on the points to be taken into consideration in selecting a boiler, together with installation notes, with special reference to chimney requirements. Ratings are given for both steam and water boilers, including 26-in., 31-in. and 47-in. series including six or more sizes. Size, 4¼-in. x 8 in. Pp. 24.

Monash Vacuum System of Steam Heating, featuring the Monash thermostatic vacuum valve, is discussed in a well-prepared catalogue issued by the Monash Engineering Co., Chicago, Ill., sole selling agents for the Monash-Younker Co. The construction of the valve is described as very simple. The valve is nickel-plated all over, with polished top, union and nipple. The thermostatic diaphragm is made of phosphor bronze from the company's own metal formula and is rolled to dimensions found by tests to best meet the requirements of service. The thickness of the metal walls, it is stated, is approximately 125 per

cent greater than in other types. The thermostatic diaphragm has been built to prevent rupture. The outer edges are rolled around a brass ring to stiffen the construction, while the center reinforcements are swaged over the walls of the diaphragm under pressure, to induce tightness and rigidity. Special emphasis is laid on the point that the diaphragm is not attached to the cover or body of the valve, but is dropped into its place in the valve between the plunger and the adjusting screw. At the same time it is impossible for it to get out of alignment. Size 6 x 9 in. (standard). Pp. 28.

Farnsworth Steam Utilities, including tilting traps and duplex boiler feeders, are treated in a new catalogue published by the Farnsworthy Mfg. Co., Boston, Mass. This system is designed to collect condensation and return it directly into the boiler. The catalogue is devoted mainly to the mechanical construction of the traps. The company states that in the Farnsworth tilting traps it has eliminated the troubles incidental to packed trunnions, with their liability to bind and leak. The oscillations of the tank on knife-edge trunnions operates a straightway Everlasting blow-off valve. Various styles of traps are produced by an ingenious arrangement of additional valves, always employing a positive valve control. The principal lines are illustrated in the catalogue, including the duplex boiler feeder, non-return trap, variable pressure trap, 3-valve lifting or pumping trap. Size 6 x 9 in. (standard).

Valve World, for June, 1916, the monthly periodical of the Crane Co., Chicago, Ill., has as its principal article a discussion of the "Open-Hearth Process" of making steel, by L. W. Spring, the company's chief chemist and metallurgist.

The New Sunbeam Sectional Boilers.

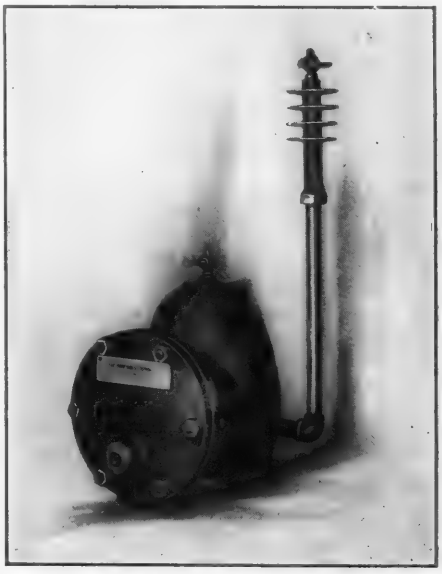
Definite information is now available concerning the new line of house-heating sectional boilers, both square and round, which are being manufactured by the J. L. Mott Iron Works, New York, under the name of Sunbeam. In a catalogue, the "Fitters' Companion," just issued by the company, the new line is described in detail. Each pair of illustrations is accompanied on the opposite page by detailed information as to sizes, ratings and prices, together with a very complete statement of the basis used in establishing ratings and a statement of the factors used in the calculations by which the ratings are obtained. The company is also now manufacturing a line of plain radiators from one to five columns, as well as indirect and wall radiators, etc.

A unique feature of the catalogue is a complete essay on "How to Heat Buildings," giving all the up-to-date data on heat losses from buildings, how to adapt radiation for different conditions and how to figure radiation for different climates.

It is stated that the well-known features of the Sunray boilers, long made by this company, have been largely carried out in the new Sunbeam line. Size 4 x 7¼ in. Pp. 160.

Unusual Type of Constant Flow Steam Trap.

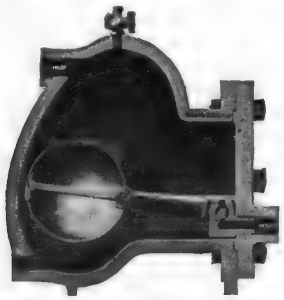
The use of a Corliss valve in a steam trap of the constant flow type is the distinguishing feature of the Lindstrom steam trap, which is a product of the Plant Engineering & Equipment Co., 6 Church Street, New York. By the use of this arrangement of valve, it is stated that scale, grit, mud is easily kept out of the trap, nor can it pass through the valve opening when the trap is discharging. This is because the valve never draws away from its seat. At the same time the condensation has a free, unobstructed passage through the valve. By referring to the accompanying illustration, it will be noted that the trap is always water-sealed, as the condensation never entirely leaves the trap. This also has the advantage of preventing the escape of steam.



LINDSTROM TRAP FITTED WITH PENCO THERMO GAUGE.

In connection with this trap the company is furnishing a thermo-gauge accessory which will tell instantly by the sense of

touch whether or not the trap is leaking. The thermo gauge is made of brass, with disc radiator and spring cock. When the trap is tight, the radiator in the gauge is filled with water and is cold, but when the



CONSTRUCTION OF LINDSTROM TRAP.

trap is leaking, the radiator is always filled with steam and is very hot to the touch. With this device one or more leaky traps in a bank of traps connected to a manifold return are instantly determined.

Retirement of the Howard Thermostat Co.

Announcement is made of the retirement of the Howard Thermostat Company, Oswego, N. Y., from business. The factory equipment, stock on hand, patents, good will, etc., have been purchased by the Minneapolis Heat Regulator Company, Minneapolis, Minn. The deal was negotiated by William R. Sweatt, president of the Minneapolis company. For the present, the Minneapolis company will furnish the trade with Howard devices.

The transaction marks the retirement of an old-established concern, the Howard Thermostat Company having been in business since 1893.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until August 1, 1916, for the construction of the U. S. Post Office at Newburyport, Mass.

Until August 2, 1916, for the remodeling of the U. S. Custom House at New Orleans, La.

Until August 7, 1916, for the mechanical equipment, except elevators, lift and lighting fixtures for the U. S. Post Office at Portland, Ore.

Until August 16, 1916, for the construction complete of the U. S. Post Office at Newark, O.

Until August 28, 1916, for the extension, remodeling, etc., of the U. S. Post Office and Custom House at Nashville, Tenn.

ADVERTISERS' INDEX

	Page
American District Steam Co	78
American Blower Co	71
American Radiator Co	Back Cover
Armstrong Mfg. Co	61
Badger & Sons Co., E. B	—
Bayley Mfg. Co	75
Bicalky Fan Co	10
Bishop-Babcock-Becker Co	62
Bonitz Co., D. A	71
Bristol Co., The	Front Cover
Carrier Air Conditioning Co	70
Carrier Engineering Corporation	5
Connersville Blower Co	3
Dahlquist Mfg. Co	61
Davis Regulator Co., G. M	82
Detroit Lubricator Co	65
Dole Valve Co	Front Cover
Dunham Co., C. A	10
Economy Pumping Machinery Co	74
Farnsworth Co., F. C	81
Foster Engineering Co	79
Foxboro Co., The	63
Garden City Fan Co	8
Gurney Heater Mfg. Co	Front Cover
Hornung, J. C	79
Ilg Electric Ventilating Co	68
Jenkins Bros.	63
Johns-Manville Co., H. W	64
Johnson Service Co	4
Knowles Mushroom Ventilator Co.,	Front Cover
Lavigne Mfg. Co	78
Marsh Co., Jas. P	3
Mason Regulator Co	Front Cover
Monash Engineering Co	74
Mueller Mfg. Co., H	76
Nash Engineering Co	8
National Air Cell Covering Co	76
National Regulator Co	66
National Tube Co	73
Parker Supply Co	—
Powers Regulator Co	Third Cover
Patterson & Co., Frank	77
Ric-Wil Co	80
Ross Valve Mfg. Co	Front Cover
Sarco Company, Inc	81
Sims Co., The	82
Spencer Turbine Cleaner Co	70
Sprague Electric Works	70
Standard Thermometer Co	74
Standard Wood Pipe Co	80
Sturtevant Co., B. F	67 and 69
Syracuse Faucet & Valve Co	77
Taylor Instrument Companies	72
United Vacuum Appliance Co	72
Webster & Co., Warren	6-7
Westinghouse Electric & Mfg Co	75
Wyckoff Sons Co., A	80

TRADE AND MISCELLANEOUS NOTES

Coming Events.

July 19-21, 1916.—Semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Detroit, Mich. Headquarters at the Hotel Statler.

Deaths.

J. B. Wise, president of the J. B. Wise Co., Watertown, N. Y., died June 7, in Atlantic City. Mr. Wise had long been identified with the heating and plumbing supply trade. He was 58 years old.

John G. Fern, persident of the Cincinnati (Ohio) Master Plumbers' Association and a well-known heating and plumbing contractor of that city, died in Cincinnati, April 23. Edward B. Kleine has been elected president of this association to fill the unexpired term.

Elias Berla, Newark, N. J., heating and plumbing contractor, died at his home in Newark, June 19. Mr. Berla was 78 years old. He was one of the oldest heating and plumbing contractors in Newark, having been identified with the trade throughout his business career. Mr. Berla was born in Germany, coming to this country at the age of 18. He has served as a freeholder for Essex County and was for 24 years president of the German Hospital. He leaves three daughters and two sons.

Miscellaneous Notes.

Detroit, Mich.—A proposed ordinance has been offered to the common council of Detroit giving the board of health power to formulate regulations for the heating, sanitation and ventilation of Detroit theatres of all kinds and to enforce its recommendations. Health Officer Price states that a campaign against unhealthful conditions in the moving picture theatres of the city will be started if the ordinance is enacted. The introduction of the ordinance is the result of a recent investigation conducted by the health board.

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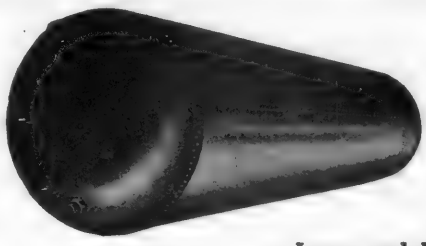

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Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Hancock, Mich.—A proposition was to come up for vote recently in Houghton, Mich., to build a new high school building at that place, together with a separate heating plant. The project was estimated to cost $225,000.

Central Supply Association held its summer meeting in Chicago, June 22, at the Auditorium Hotel. Addresses were made by George H. Bailey, president of the Bailey-Farrell Mfg. Co., Pittsburgh, on "Figuring Profits Monthly," and by John J. Arnold, vice-president and manager of the foreign department of the First National Bank of Chicago, on "Trade Acceptance vs. the Open Account."

Eastern Supply Association, at its meeting in New York, June 14, passed on the important proposition which it has had under consideration for further safeguarding the granting of credit. A set of rules which were drawn up by a committee of the Central Supply Association and known as the reciprocal credit reporting bureau proposition, was finally adopted. These rules as submitted by the committee are designed to place the exchange of credit information upon a co-operative and exact basis, so that firms giving may also receive information. Membership in the bureau is limited to members of the Eastern Supply Association, and the bureau's service is for the use of members only. The key numbers furnished by the bureau, or their equivalents in firm names, must not be turned over to any outside exchange, bureau or agency organized for the purpose of collecting credit information. Following are the rules:

Rule 1.—Each member shall furnish to the bureau a list of customers. The bureau will then place these names on cards showing the number of each member selling the party.

Rule 2.—The names of new customers, and those parties refused credit, shall be filed with the bureau at least once a month.

Rule 3.—Upon receiving one or more numbers from the bureau in reply to an inquiry, consult the key. After noting the members indicated by the numbers received from the bureau, the inquiring member is then to obtain the desired information, either by telephone, messenger or mail, from the co-operating members indicated by the numbers received. The key shows

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of this big catalog, which contains lots of valuable information, data, charts and suggestions for specifications on Air Line and Return Line Vacuum and Vapor Heating Systems, and illustrates and describes thoroughly the big line of RELIABLE Vacuum and Vacu-Vapor Heating Equipment—RELIABLE Vacuum Pumps, VacUstats, Vacu-Traps, Vacu-Checks, Vacu-Graduate Packless Radiator Valves, "4 V" Vent Valves, etc. This will not obligate you. We want you to see this catalog. You will be interested in it!

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name of each member, credit men and address.

Rule 4.—Members must have a bona fide order from, or open account with, the party on whom inquiry is made.

Rule 5.—All exchanges must be accurate and information held strictly confidential for the use of credit men only, and under no circumstances divulged to the subject of the inquiry.

Rule 6.—A coupon shall accompany each inquiry. If party inquired about is not listed, coupon will be returned. The bureau will issue coupon books for the convenience of members. Value of coupons, ten (10) cents each.

Rule 7.—All inquiries are to be answered on the day received, and by the credit man or manager, if possible, so that the ledger experience and any additional information in his possession may be furnished.

General Conditions.—A compliance with these rules in the interchange of credit information leads to accuracy, reciprocation, promptness and confidence. Their observance will mean a closer contact between the members of this association, and be of great assistance in credit investigations.

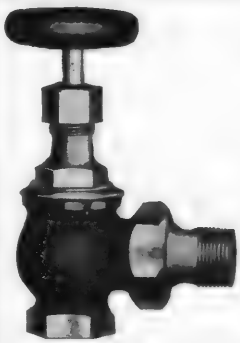
An address on "Price Cutting and Dishonest Advertising" was delivered by C. E. La Vigne, formerly special agent of the Federal Trade Commission.

E. d'Esmenard, a charter member of the French heating engineers' society, is in New York on business for the French government, with headquarters at Schneider & Co., 44 Whitehall Street, New York. He was a recent caller at the office of the Heating and Ventilating Magazine. Mr. d'Esmenard brings the information that Auguste Beaurrienne, of Paris, who is a member of the American heating engineers' society and was present at one of its recent annual meetings, is now at Montlucon, Department of Allier, France, in the shell-charging shops. He was stationed at Belfast during the early stages of the war.

Municipal Engineers of New York City, at their meeting May 15, were favored with an address by Frank G. McCann, chief of the engineering staff of the New York City Department of Education, on the heating and ventilation of the New York public schools.

Master Boiler Makers' Association, at its tenth annual convention in Cleveland, O., May 23-26, elected D. A. Lucas, Havelock, Neb., as its new president. P. A. Clemens, Chicago, was elected president of the Boiler Masters' Supply Association.

Philadelphia, Pa.—According to a report of the medical school inspectors of Philadelphia, which has been submitted to the Board of Education through Director Krusen, of the Department of Health and Charities, of the 331 public schools in Philadelphia, 141 are in such a condition, from the standpoint of health and safety, as to be classed as "bad." In twelve months, the report shows, the conditions have improved less than 2%. The faults found in the buildings include the items of improper ventilation, inadequate light, overcrowding, lack of fire escapes and inadequate playgrounds.



Jenkins Bros. Radiator Valves

Angle, Globe, Corner, Offset, Fractional.

The Jenkins Bros. Standard of construction embodies high grade steam metal, heavy design, careful workmanship and renewable disc, assuring strength, pleasing proportions, absolute tightness, and good service.

Consult catalogue No. 20.

Jenkins Bros.

New York Boston Philadelphia Chicago Montreal London

SPECIFY— FOXBORO —INSTRUMENTS

TRADE MARK

TO INDICATE or RECORD TEMPERATURES and PRESSURE

They have a distinctive quality with a fineness of mechanical detail which insures Accuracy and Durability under the hardest Service

THE FOXBORO COMPANY, FOXBORO, MASS.

New York Chicago St. Louis Birmingham, Ala. San Francisco

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Building Operations for May furnished the best monthly statement since January, the totals as compiled by the American Contractor, of Chicago, being $113,904,515, as compared with $86,469,129 for May, 1915, a gain of 32%. These figures are for 108 cities. In view of the uncertainties in the delivery of building materials and the price fluctuations, this record is considered remarkable. The April building operations were also larger than for the previous April, the figures being $89,812,962 for April, 1916 and $77,056,478 for April, 1915, an increase of 16%. During May the only large cities that did not share in the general increase were Baltimore, Boston, Buffalo, Cincinnati, Des Moines and the Borough of the Bronx, New York. The other boroughs of New York, however, more than made up for the slump in the Bronx, giving a total of $28,902,486, and compared with $25,006,076 in May, 1915.

Central Station Heating Notes.

Davenport, Ia.—The proposed renewal of the heating franchise of the People's Light Company has become the subject for a lively discussion in that city, the council dividing on the proposition. The company's franchise expires in 1921, but a 25-year renewal had been asked for at this time to permit improvements and repairs to the system.

One of the features which has delayed final action is a proposition to tax the company 6 per cent. on its gross receipts. H. C. Blackwell, general manager of the company, stated that the company was now making only $1,700 profit a year. It was also suggested that an expert accountant be engaged to check the company's statements. There are at present about 130 consumers in the business district.

New York Steam Co., New York, has elected William J. Baldwin, Jr., as a director of the company. Mr. Baldwin is the company's commercial engineer.

Montreal Heat, Light & Power Co. and the Cedar Rapids Mfg. & Power Co., both of Montreal, Canada, have consolidated. The new corporation will have an authorized capitalization of $75,000,000, of which $65,300,000 will be issued to provide for the acquisition of the stocks of the two companies. For each share of the Montreal Light, Heat & Power three shares of the new company will be exchanged, while for the Cedar Rapids concern the exchange will be share for share.

Spokane, Wash.—Efforts have been made by the central labor council of Spokane to place the Merchants' Central Heating Company on the unfair list in the matter of em-

Installing J-M Sectional Conduit at State School of Mines, Rapid City, South Dakota

An economical underground heat transmission system that makes the Central Heating Plant practical

The increase in the number of Central Heating Plants has necessitated the development of a simple and efficient protection for underground steam lines.

The net saving of the centralized heating plant lies in the efficiency of the transmission lines.

J-M Sectional Conduit conveys steam at an efficiency of 90% or over. This complete system embraces ducts, duct filler or insulation, supports, drains, racks for the pipes and shutters at the entrance of each line into a building to prevent the passageway of vermin from one building to another.

As an investment, this system pays for itself in 3 years.

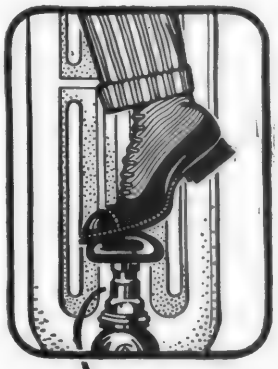
Its efficiency is high, the first cost is the only cost and its life is endless.

The nearest J-M Branch will furnish full information.

H. W. Johns-Manville Co.

Boston Cleveland Philadelphia St. Louis Seattle
Chicago New York Pittsburgh San Francisco Toronto

DETROIT PACKLESS RADIATOR VALVES



STRONG & STURDY—

a chance blow cannot bend this handle stem

Abuse of all kinds such, for example, as stepping on the handle, has no effect on it.

These valves are fool proof and cannot be tampered with from the outside.

They are strong and sturdy wherever strength is required.

Send for Booklet V.

SPECIFY GENUINE DETROIT PACKLESS VALVES

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO, CANADA

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

ployment of union engineers and the paying of the union wage scale. It is stated that the company is paying about 19 cents per hour and the union men want $3.50 to $4.50 per day for engineers. In addition, it is claimed, the men are working from 10 to 12 hours a day, to which the union objects. The central council has not taken final action on the matter.

Cleveland, O.—A contract made by the city to supply steam heat from its municipal plant to the Cleveland Museum of Art during the summer months has brought out a report that this service is costing the city from $30 to $50 per day net. The heat is needed during the summer to protect the paintings and art curios from the effects of dampness. In the winter months the museum pays 25 cents per 1,000 lbs. of steam, and in summer 40 cents per 1,000 lbs. According to City Lighting Commissioner Davis the contract is fairly equitable for winter service, but is suicidal for the city in summer. Because of the layout there is no return of the condensation to the Fairmount pumping station and the lines to the museum are, therefore, the most uneconomical. The waterworks engineers figure that the average cost of steam generated at the station is 41 cents per 100 lbs. In summer it is necessary to keep the lines filled with an extra boiler in operation solely for the museum. The city heating system had its inception when formerly Mayor Baker opposed a separate heating plant in Wade Park where the museum is located.

Logansport Heating Co., Logansport, Ind., has petitioned the Public Service Commission for authority to issue $250,000 in preferred stock, the revenue to be used in reimbursing the company's treasury for money expended in betterments and extensions.

Elyria, O.—The case of Beal, Theobold & Thomas against the county commissioners has been decided by Judge Thompson. This was a case involving the cost of the steam heating pipe line at the county infirmary. The plaintiffs claimed that they did not agree to build the pipe line when they secured the contract for heating the building. The judge decided in favor of the commissioners who had decided that the heating company should bear the cost of the line.

Grand Rapids, Mich.—The attention of the city council has been called to the fact that if the request of the Consumers' Power Company is granted, permitting it to lay conduits and heating mains in Fountain street and Ionia avenue to provide

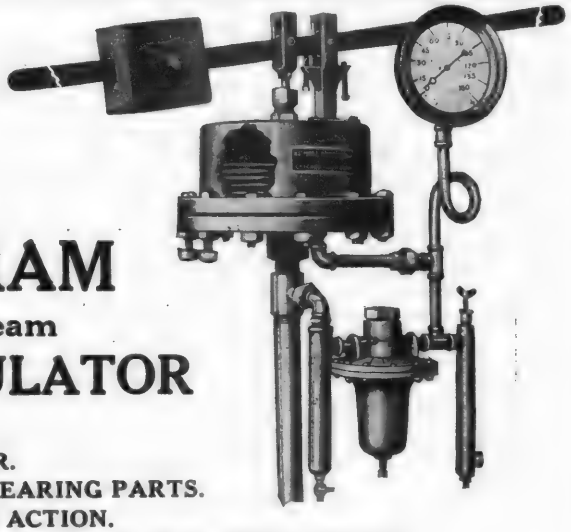
SIX VITAL FEATURES

of the

METAPHRAM

High Pressure Steam

DAMPER REGULATOR



DIRECT-ACTING
REQUIRES NO AUXILIARY POWER.
NO PACKINGS, PERISHABLE OR WEARING PARTS.
ABSOLUTELY GRADUATED IN ITS ACTION.
PROVIDED WITH ADJUSTABLE FULCRUM AND SLIDING LEVER.
ALL METAL AND DUST PROOF.

A simple, sensitive device which will automatically operate a balanced draft damper on a slight variation of steam pressure. Designed for boiler pressures from 15 to 175 lbs.

Send for Metaphram Circular.

NATIONAL REGULATOR CO., 208-212 Jefferson Street, Chicago

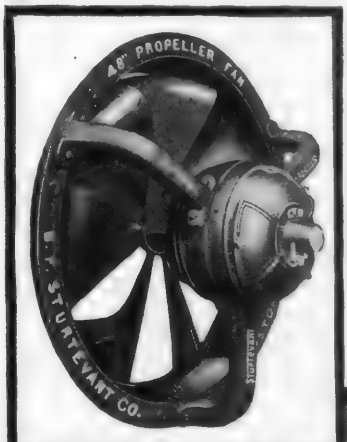
Manufacturers of all types of Automatic Temperature Regulating and Humidifying Apparatus

Sturtevant

(REG·U·S·PAT OFF·)

FANS AND AIR WASHERS

The exceptional value of Sturtevant Apparatus is largely due to the guarantee which stands back of it. The apparatus is right in every particular and we not only keep in constant touch with customers until the apparatus is in satisfactory operation, but we are on call at any later time to offer our service and advice. We are not merely interested in the sale of the apparatus but gives with it a service which is unequalled by any other company.



We have the largest and most capable body of trained fan engineers in the world.

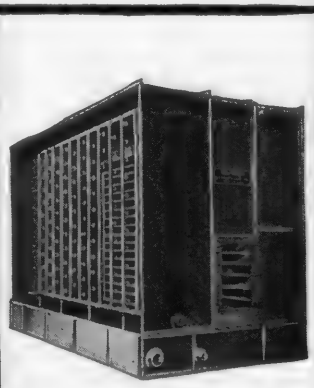
General Catalog 195-W describes our line.

B. F. STURTEVANT COMPANY

HYDE PARK BOSTON, MASS.

And All Principal Cities of the World. Selling Agents for Sanford Riley Stoker Co., Limited

"THE RILEY STOKER"



Sturtevant Propeller Fan
Electric Multivane Fan
Sturtevant Air Washer
Ready-to-Run Portable Ventilating Set—Made in five sizes—discharge can be turned in any direction.
Multivane Fan Wheel

service for the new Grand Rapids Savings Bank Building, it will mean that the city recognizes the right of the company to operate under the franchise of the Grand Rapids-Muskegon Power Co. The franchise of the latter company, it is also pointed out, does not provide for a heating business.

Manufacturers' Notes.

Borden Co., Warren, O., announces that W. A. Phillis has been appointed advertising manager in charge of the publicity and advertising of Beaver square-end pipe cutters and die stocks. Mr. Phillis has lately been connected with the metallurgical and advertising department of the National Tube Co. of Pittsburgh.

A. M. Byers Co., Pittsburgh, Pa., has acquired under long lease the properties of the Susquehanna Iron Company at Columbia, Pa., consisting of two mills manufacturing muck bar and skelp iron. Hereafter the newly acquired mills will be devoted to the manufacture of pipe ranging from ¼-inch to 12-inch in diameter, giving the company an additional capacity estimated at approximately 75,000 tons per year.

J. C. Hornung, Chicago, Ill., engineer for central heating and power plants, announces the removal of his offices to 343 South Dearborn street.

SUPREME
FOR
RESTAURANTS and LUNCH ROOMS

ILG SELF-COOLED MOTOR PROPELLER FANS

ILG ELECTRIC VENTILATING CO.
158 Whiting Street, CHICAGO

Sturtevant
(REG. U. S. PAT. OFF.)

Type H Air Washer

The heavy sales of the Sturtevant Air Washer during the past two years indicate that Engineers and Architects realize its excellent features and its mechanical advantages over other makes.

Strainer area more than twice that of any other washer made and ten times the area of some.

Strainer designed for removal for cleaning; no bolts, clamp or latches to be manipulated and give trouble.

More nozzles per thousand cubic foot of air than any other washer.

Trap in overflow.

Supplies more water to eliminator plates for auxiliary washing than any other apparatus.

Furnished with louver diffuser plates on inlet side.

Send for bulletin, specifications and complete information.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS

And All Principal Cities of the World

Atlantic Radiator Co., Huntington, Pa., announces the appointment of Howard T. Gates as general manager of the company. Mr. Gates was formerly president of the Hudson Boiler Mfg. Co., of New York. Judson A. Goodrich, vice-president of the Atlantic Radiator Co., who has had the general management of the company, will devote his entire time to the sales department.

Sims Co., Erie, Pa., designers and manufacturers of steam specialties, including the Sims feed water tanks, announces that C.

¼ H.P. Equipment

Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

Send for catalogue

SPENCER TURBINE CLEANER COMPANY

HARTFORD, CT.

SPRAGUE ELECTRIC

OZONATORS

Keep the Air Pleasing and Wholesome

Combination Ozonator and Electric Fan

Send for Bulletin No. A-83

Sprague Electric Works

of GENERAL ELECTRIC COMPANY

527-531 W. 34th St., New York, N. Y.

Branch Offices in Principal Cities

Ninety In the Shade

Do you feel like doing much work under this condition?

Well—it isn't necessary. You can install

Carrier Humidifiers

and cool the air to the outside wet-bulb temperature—or an average cooling of about 15° F.

Don't you feel that you owe it to yourself—and your clients—to investigate?

A card will bring our catalog 13-36, or our engineer.

CARRIER AIR CONDITIONING COMPANY OF AMERICA

BUFFALO, N. Y.

New York Boston Philadelphia Chicago

Hudson's (Detroit) Basement Store where "Sirocco" washed air increased $1,000,000 sales ten per cent.

"Sirocco" Saves 50,000 Dollars in One Department

The "Basement Store" at Hudson's great department store in Detroit furnishes a way of disposing of small stock of left-overs and attracting to the store a number of customers who might go elsewhere. It also solved the problem of using the extra basement space which had come with additions to the original building.

Sales the first few months indicated a million dollar a year business.

Then the warm wave. Sales in the Basement Store fell alarmingly. A clue to the troubles lay in the "hospital records" of the salesforce. Customers noticed the difference and suggestions like "Let's go back to the new side," showed which part of the Basement Store was pleasantest to shop in.

The new basement store was supplied with cooled washed air—the plans called for an Air Conditioning System.

An emergency order was sent to the American Blower Company and in a short time a Sirocco System was installed in the Old Basement without interrupting business.

With both sides of the Basement Store ventilated, business picked up. Instead of a million dollar business, there was over one and a half million, and Mr. Douglas, chief of the floor managers of the Basement Store, says that the most conservative estimate must credit the Sirocco System with 10% of the increase. 10% of half of a million!

Now is the hot season when similar business problems are to be found in the stores of your town. Cannot you find one and solve it? Write for Air Conditioning Bulletin.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

BRANCHES EVERYWHERE

J. Moulton, brother of the late P. A. Moulton, has been appointed manager of the company's New York office at 47 West 34th street.

Gurney Heater Mfg. Co., Boston, Mass., announces the removal of its New York offices to 11 East 42nd Street, where larger and better facilities are provided for this important branch. Richard B. Hunt is the company's New York manager.

National Metal Trades Association held its eighteenth annual convention in New York April 27-28. It was attended by 372 delegates, which is a record attendance for this organization. The new president elected at the convention is W. H. Van Deervoort, of the Root & Van Deervoort Engineering Co., East Moline, Ill.

New Firms and Business Changes.

C. F. Herington, assistant engineer in the office of the mechanical engineer of the New York Central Railroad Co., New York, has resigned to take a position with the Bonnot Company, of Canton, O., as mechanical engineer in the powdered coal department.

H. H. Hughson, formerly president of the Hughson Steam Specialty Co., Chicago, which was later merged with the Illinois Engineering Co., Chicago, has become associated with the Coon-DeVisser Co.,

"CONNERSVILLE"

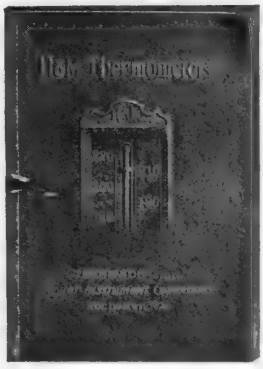
VACUUM CLEANERS EVERYWHERE

For installation in Residence, Apartment, School, Office Building, Sanitorium, Hotel, Factory, Church, Theatre, Hospital, Laundry, Library, Public Building, etc.

The Sanitary Way

Buy a "CONNERSVILLE" and Avoid Dust Dangers and Daily Drudgery

United Vacuum Appliance Co.
Connersville, Ind.



Books on Temperature Measuring Instruments for Industrial Purposes.

Covering Steam and Power Plants, Heating and Ventilating, Marine Engineering.

Covering Industries in which the primary condition of use is steam under pressure.

Covering Ice Manufacture, Refrigeration, Cold Storage and those Industries where the primary requirement is low temperature.

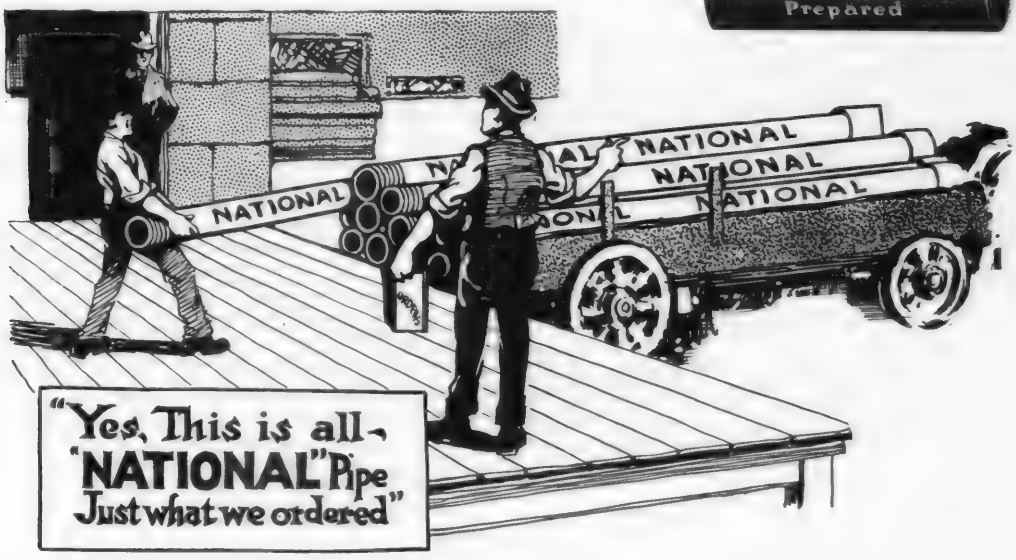
Covering Gas Works, By-Product Coke Ovens and Gas Power Plants.

We will send you a copy of any of the above works FREE, or if none of them meet the requirements of your business, write us what your Temperature Measuring problem is, and we will send you information covering it, no matter how difficult, or varied the conditions to be met may be.

The H&M Division
Taylor Instrument Companies
Rochester, N.Y.

When You Buy Pipe, Do YOU Look for the Name "National"?

It pays to be NATIONAL in Prepared



¶ The many advantages of securing "NATIONAL" Pipe make this precaution well worth while. Don't accept any "equal" or "just as good"—"NATIONAL" Pipe has no equal.

AWARDED GRAND PRIZE

¶ NOTE: "'NATIONAL' Pipe has no equal." This is not merely a manufacturer's statement; it is the verdict of the Superior Jury of Awards of the Panama-Pacific International Exposition, San Francisco, 1915—who awarded the Grand Prize (only ONE Grand Prize being awarded for each class of material) to "NATIONAL" Pipe and Allied Products **"as representing the highest development of the art."**

¶ "NATIONAL" Bulletin No. 11—History, Characteristics and the Advantages of "NATIONAL" Pipe will give you just the information you want. It's free, but you must ask for it.

¶ To readily identify "NATIONAL" material and as protection to manufacturer and consumer alike, the practice of National Tube Company is to roll in raised letters of good size on each few feet of every length of welded pipe the name "NATIONAL" (except on the smaller butt-weld sizes, on which this is not mechanically feasible; on these smaller butt-weld sizes the name "NATIONAL" appears on the metal tag attached to each bundle of pipe).

LOOK FOR THE MARK

Name Rolled in Raised Letters on National Tube Company Pipe

¶ When writing specifications or ordering tubular goods, always specify "NATIONAL" pipe, and identify as indicated.

¶ In addition, all sizes of "NATIONAL" welded pipe four inches and under are subjected to a roll-knobbling process known as Spellerizing to lessen the tendency to corrosion, especially in the form of pitting. This Spellerizing process is peculiar to "NATIONAL" pipe, to which process National Tube Company has exclusive rights.

NATIONAL TUBE COMPANY

General Sales Offices, Frick Building **PITTSBURGH, PA.**

DISTRICT SALES OFFICES:

Atlanta Boston Chicago Denver Kansas City New Orleans New York Omaha Philadelphia Pittsburgh St. Louis St. Paul Salt Lake City

Pacific Coast Representatives: U. S. STEEL PRODUCTS CO., San Francisco, Los Angeles, Portland, Seattle

Export Representatives: U. S. STEEL PRODUCTS CO., New York City

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Ford Building, Detroit, Mich., engineers and contractors. Mr. Hughson will represent the Illinois Engineering Company in Michigan.

G. S. Blodgett Co., Burlington, Vt., heating and plumbing contractor and manufacturer of the Blodgett portable baking oven and general jobber of heating has changed ownership, John S. Patrick, secretary and treasurer of the company assuming entire control. George H. Holden, the company's president, retires from the company. The business was established in 1847.

Charles W. Fortune, consulting engineer in heating, ventilating and power plant equipment, announces that he has opened an office in Los Angeles, in the Baker Detwiler Building. Mr. Fortune was formerly employed by the Los Angeles Board of Education as engineer in designing, heating and ventilating systems for the new school buildings in that city.

Contracts Awarded.

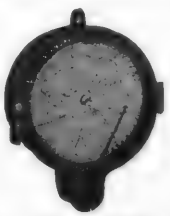
Peninsula Heating & Plumbing Co., Calumet, Mich., heating and plumbing Manistique High School, and furnishing vacuum cleaning equipment for same, for $31,330.

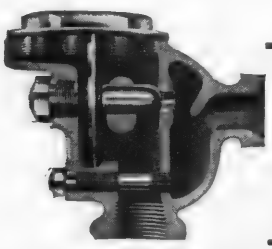
Chapman Plumbing & Heating Co., Canton, O., heating, ventilating and plumbing Daniel Worley grade school in Canton for $14,765 for the heating and ventilating, and $7,667 for the plumbing. The company will also install a vacuum cleaning system in this building at its bid of $853.

Wyoming Engineering & Construction Co., Wilkes Barre, Pa., heating and ventilating new high school in Carbondale, for $21,967.

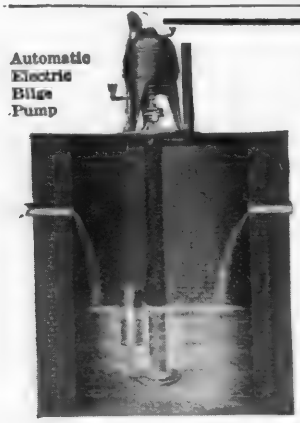
Appling-Griggs Co., Portland, Ore., steam heating and ventilating public auditorium building in Portland for $44,000. Other bids were: J. F. Shea, $46,306; Rushlight & Hastorff, $45,917; Kendall Heating Co., $48,969; Finnegan Bros. & Hill, $55,849; W. G. McPherson Co., $56,600, all of Portland.

Your Choice of Seven Types
is offered in our line of
Standard Recording Thermometers
We make a specialty of hot water and steam indicators
Send for Catalogue VH
Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.





TRADE MONASH MARK
MONASH THERMOSTATIC VALVE
FOR LOW PRESSURE VAPOR AND VACUUM HEATING SYSTEMS
Self-cleaning—Noiseless and Positive in Service—Automatically prevents loss of steam—Has a vertical seat which cannot stop up with sediment and a loose thermostat which cannot rupture. Send for our latest catalogue.
Chicago · **MONASH ENGINEERING COMPANY** · New York



ECONOMY SEWAGE EJECTORS,
Bilge Pumps and Cellar Drainers
Are AUTOMATIC—RELIABLE—EFFICIENT For EVERY PURPOSE
KEEP THE BOILER PIT DRY
ASK FOR CATALOG
Economy Pumping Machinery Company
116-118 N. Carpenter Street **CHICAGO**
Phones: Monroe 5941-5942

The Vital Problem

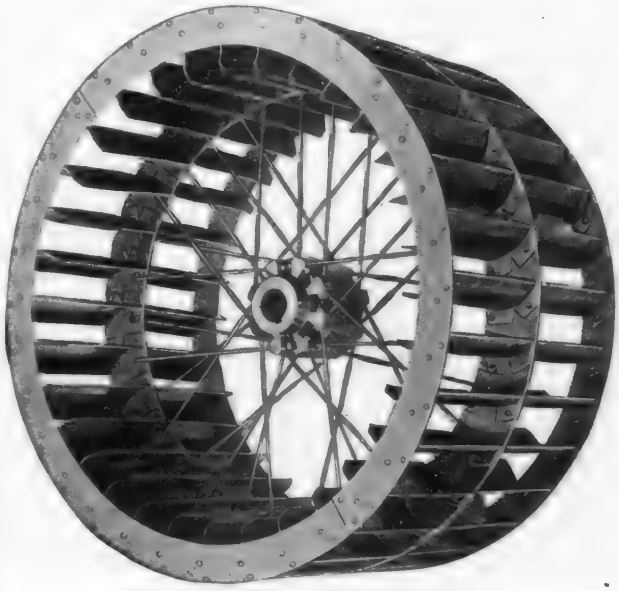
in the design and construction of buildings where large audiences assemble is the ventilation problem.

Roselle High School—Roselle Park, N. Y.

Westinghouse Motors

have proven themselves to be the ideal motors for driving ventilating equipment.
The quiet and reliable operation of these motors has led architects and engineers to select them for many of the leading public buildings in the country.
Our engineers will be glad to assist you in drawing up specifications on your next job.

WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH, PA.
Sales Offices in All Large American Cities 353



For Heating, Ventilating, Drying and Mechanical Draft Purposes use the

PLEXIFORM FAN

because of its high efficiency, great strength, lightness and low cost of installation.

Plexiform wheel construction is as adaptable for double width as for single width fans, and is the **only type** of **multiple blade wheel fan** that is **equally adaptable** for **high** or **low pressures without change in design and construction.**

We have Fans of **standard Plexiform construction** handling air at —50 deg. and gases at 1000 deg. temperature.

Write for catalogs.

BAYLEY MANUFACTURING CO., Milwaukee, Wis.

Service Is What You Want

and that is the very thing we want to give you—and it is the identical thing you will get in any

13160

Mueller Reducing and Regulating Valves

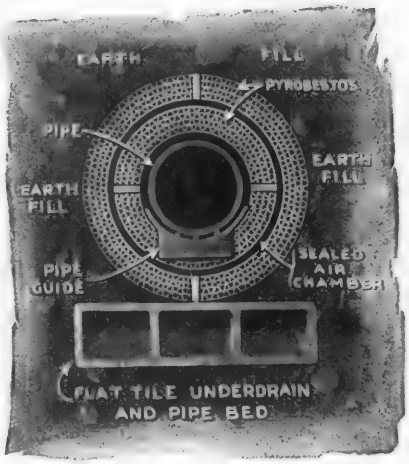
you may select for water, steam, air, oil, gas, etc. Let us know your wants and we will suggest to you a valve that will meet your requirements. We want your inquiry so that we may give you complete information. Get our No. 5 Catalogue.

H. Mueller Mfg. Co.

Decatur, Ill.

New York
145 W. 30th St.

San Francisco
589 Mission St.



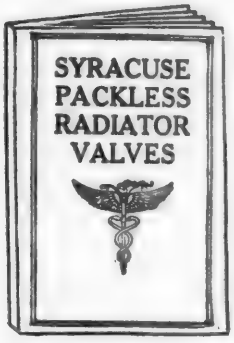
Pyro-Bestos Underground Pipe Insulation

For piping from central heating or power station to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also as underground Pipe Conduit for heating private Auto garages direct from House heating system. Lasts longer than Wood; in fact indefinitely. Easily applied and of reasonable cost. Is water repellant—does not absorb moisture like Magnesia, Infusorial Earth or the loose filling in Tile Conduit systems, all of which materials acting like a wet sponge held against the piping soon rust holes in the piping. We have cases on record where Insulations of the absorbent type have totally destroyed the piping in five years and less after installation, making it necessary to go all over again with the cost of digging trenches, new piping and new Insulation. No material of an absorbent nature should be placed around underground piping. Test all underground Insulations offered you by placing a fragment in a glass of water. If it absorbs water, don't use it.

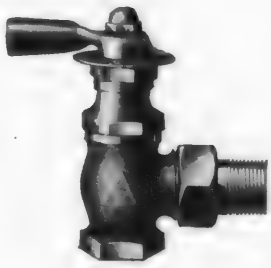
National Air Cell Covering Co.

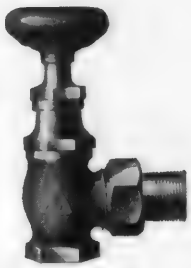
210-220 Van Brunt St., Brooklyn, N. Y.

THREE NEW ONES



Catalogue


Style 37


Style 38

ALL OF THEM DANDIES!

Send for the catalogue which tells about these new style valves.

SYRACUSE FAUCET AND VALVE COMPANY

Office and Factory
Syracuse, N. Y.

Sweet's Catalogue Page 1249
GEO. A. WELD CO., 79 Milk Street, Boston

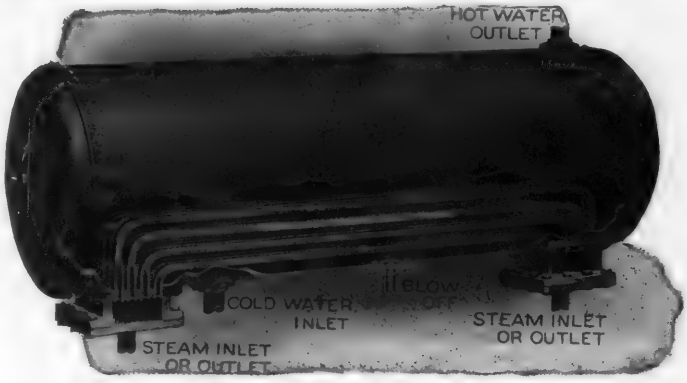
220-224 West 42nd St.
New York City

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS

of the

PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

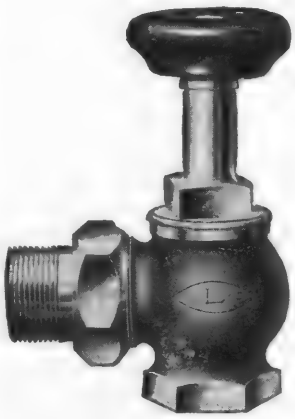


Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities Can be Furnished.
Send for Catalogue.

FRANK PATTERSON & CO., 26 Cortlandt Street, New York

Representatives in all Principal Cities



Remember the name

Lavigne Packless, Quick - Opening Steam Radiator Valves.

Built Right—To Stay Tight. All good jobbers handle them.

The Nominee of the Trade

In pre-election days we hear a great deal about the nominee of this or that party and his past and future performances. It is just as important to know the past record of a piece of mechanism as of a politician for the reason that past records are useful in gauging future performances. In the radiator valve business, for example,

Lavigne Packless Valves have been elected to a position of trust over seven years ago and continue to hold the respect of every user.

The features which have made these valves so pre-eminently the leaders in the Packless Valve field are:—

The impossibility of leaks, either of air, water or steam.

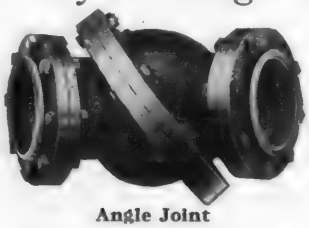
The speed with which they can be completely opened or completely closed.

The freedom from mechanical troubles.

The striking beauty and graceful appearance of the finished product.

LAVIGNE MANUFACTURING CO.
Detroit, Mich.

In "pipe fitting" if your flanges do not face up, don't worry. You will not have to bend your pipe or face off your flanges if you



Angle Joint

Use the "ADSCO"

Angle Joint

It will fit any place, good for any angle from 90 degrees to a straight line, and made in all sizes.

Let us help overcome your troubles.

Write today for prices

AMERICAN DISTRICT STEAM COMPANY

General Offices and Works: NORTH TONAWANDA, N. Y.

NEW YORK
West Street Bldg.

CHICAGO, ILL.
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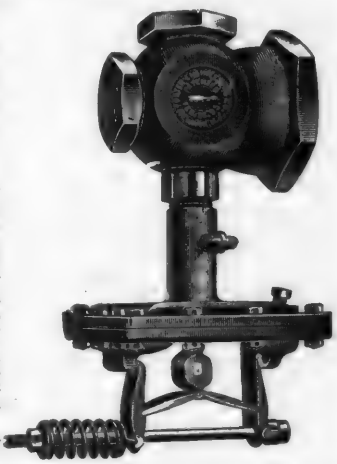
For Safety, Sureness of Operation and Durability

FOSTER PRESSURE REGULATORS

FOR STEAM HEATING SERVICE

(Classes "Q" and "Q H") lead the way. Designed especially for steam heating, and suitable for vacuum systems, for delivery pressure of from 1 to 15 lbs.

We make several types of pressure regulators—those shown in the illustrations here were designed particularly for steam heating service, and they are very sensitive, reliable, high grade in every particular and superior to other makes in construction and workmanship. There are no weights or close fitting pistons, and are easily adjusted to the desired pressure between 1 and 15 lbs. Made in sizes ¾ inch to 2 inches inclusive, composition body. Larger sizes are fitted with composition renewable seats.

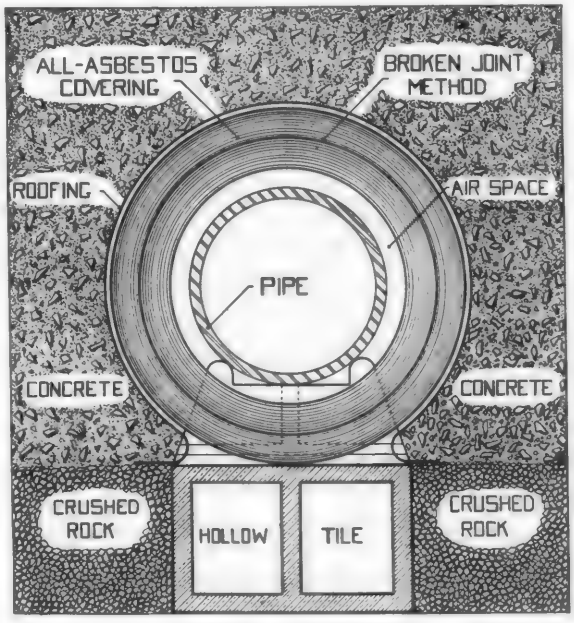


Class "Q" Class "Q H"

These Valves are fully explained on Pages 29 to 33 of our General Catalogue, No. 20.

FOSTER ENGINEERING CO., Newark, N. J.

CHICAGO, ILL., 180 North Dearborn Street
PITTSBURGH, PA., 518 Park Building
PHILADELPHIA, PA., 601 Harrison Building
BOSTON, MASS., 161 Summer Street



A type of Heating Mains with few specials—easily installed—permanent

INDESTRUCTIBLE

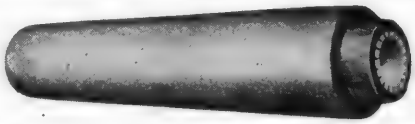
Conduit is made of CONCRETE and every LOCALITY "has the MAKIN'S"

Let me furnish you the covering, expansion joints, etc., together with complete specifications to meet your case.

Ask for quotations or estimates.

J. C. HORNUNG
ENGINEER
343 South Dearborn Street
Chicago

STANDARD Steam Pipe Casing



For Insulating Underground Steam Pipe. Tin Lined, or Unlined.

Every salesman has his argument in order to sell the product he represents. Listen to our argument, be the judge, and you will find same not theoretical but practical, and from actual experience.

When you cover your steam line with our make of casing you have the assurance that the line will be constructed so that no heat will escape, and will be water tight as well, with ample space for air chamber.

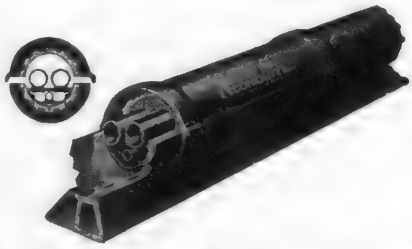
Should occasion arise that it is necessary to get at the steam pipe, our covering CAN BE TAKEN APART WITHOUT DESTROYING THE STAVES in the sections of casing, and the same casing can be used again. LET US EXPLAIN HOW.

If your line runs in different branches we will build the casing in exact lengths so that you will not have to cut any sections, which means no waste or extra expense to you.

Our method of building covering will be to your interest. Our product is right, attention prompt, and prices low.

SEND FOR BOOKLET

Standard Wood Pipe Co.
WILLIAMSPORT, PA.



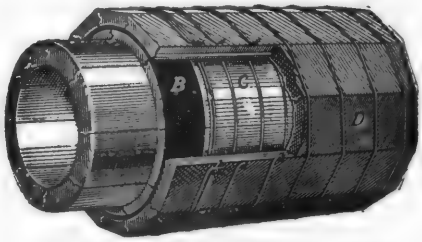
The Judgment of the Architect
and the ability of the contractor are never questioned in after years when the

RIC-WIL METHOD

of insulating underground pipes is used. The great saving of fuel, the element of permanency, the highly efficient underdrainage, the elimination of repair expense—all combine to make Ric-wiL the most satisfactory and most economical conduit for outdoor transmission of heat.

NOW is the time for new installations or repairs—delay will cause needless inconvenience and expense. Investigate TODAY.

THE RIC-WIL CO.
623 New England Bldg. Cleveland, Ohio



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

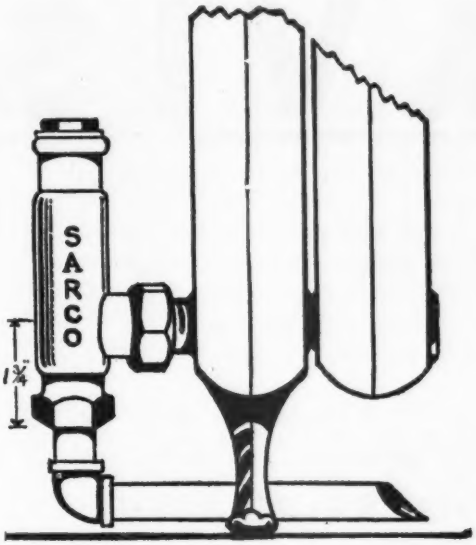
Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

ELMIRA . . N. Y.

Chicago, Ill., 551 West 14th Place
Pittsburgh, Pa., Johnson-Peter Co.
Pittsburgh Terminal Warehouse



THE

RADIATOR TRAP SARCO

fits in places where other style traps can't be used without extra expense for special casting or fittings. It is furnished with 1¾" distance between openings or with 3" as desired. You can also install it at any angle without affecting its efficiency. It adapts itself at once to any location of return piping, which means reduced installation cost, and avoidance of delay in waiting for special traps not carried in stock.

The Sarco is used on low pressure, vapor or vacuum heating systems. Absolutely noiseless in operation, self-cleaning, cannot freeze, because of no water seals, cannot get air bound and eliminates water hammer.

Try one and be convinced.

Send today for prices.

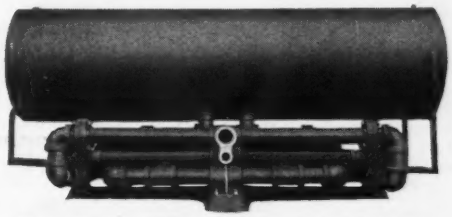
SARCO COMPANY, Inc.

Woolworth Bldg.

NEW YORK

CHICAGO
Monadnock Block

DETROIT



Side Showing Steam Inlet and Vent Outlet

The Farnsworth Duplex Boiler Feeder

feeds condensation direct from the heated apparatus into your boilers under high or low pressure, and conserves the heat units, which saves coal and eliminates pumps.

It also feeds condensation into high or low pressure boilers from vacuum heating systems, separates the air and eliminates the use of vacuum pumps; has two chambers, one is always open receiving the condensation while the other is under pressure feeding it into the boiler. It handles all the necessary make up water into boilers and absolutely eliminates boiler feed pumps, does better work, and requires 75% less steam in its operation. It needs no lubricating oils, is absolutely packless, has no trunnion stuffing boxes, weights, levers, or any operating parts inside of the tank. The operating valves are the only parts and are on the outside.

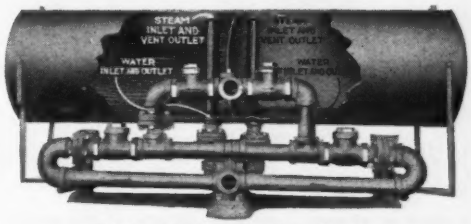
The whole apparatus is built heavy and rugged, is very dependable, and the control of the Everlasting Valves is very positive, as the alternate filling and emptying of the opposite chamber oscillates the tank and operates the control valves. For further particulars send for our catalogue.

Farnsworth Mfg. Co.

Engineers

65 Beverly St., Boston, Mass.

(Successors to F. C. FARNSWORTH CO.)
New York Office and Show Room
72 Trinity Place



2½-in. Duplex Boiler Feeder
Side Showing Water Inlet and Outlet

Davis Pressure Regulators Save Steam

DAVIS

When economy suggests or necessity demands the use of steam at less than boiler pressure use A DAVIS REDUCING VALVE.

This automatic device saves steam by delivering the exact amount required and no more. Being simple in construction and positive in action you may rely upon it for efficient service.

For forty years Davis Valves have been used by men of experience who demand the best possible results from their equipment.

G. M. DAVIS REGULATOR CO.
436 MILWAUKEE AVENUE CHICAGO
New York Boston Philadelphia Pittsburgh San Francisco

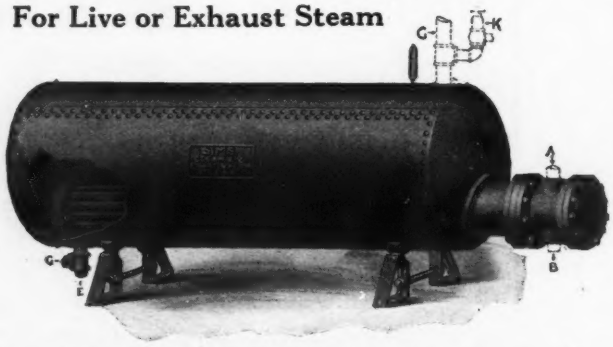
Send for Complete Catalog No. 8

VALVES

SIMS CLEAN E-Z STEAM TUBE HEATER

For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

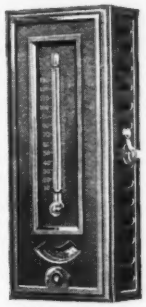


requiring large quantities of hot water. This type of heater should be used in preference to circulating generator and storage tank—or instantaneous heaters.

Special attention given to all kinds of water heating problems based on long experience in this work.

Valuable tables have been prepared, showing heater capacities using steam at various pressures. These tables are yours for the asking.

THE SIMS CO., 18th St., Erie, Pa.



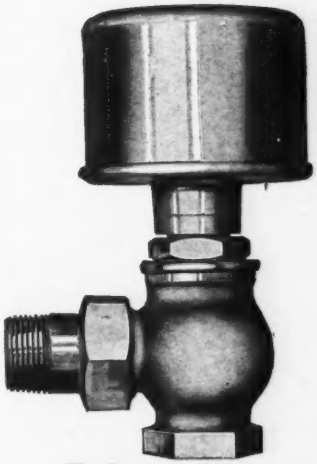
The Powers Thermostat Model D

Automatic Heat Regulation

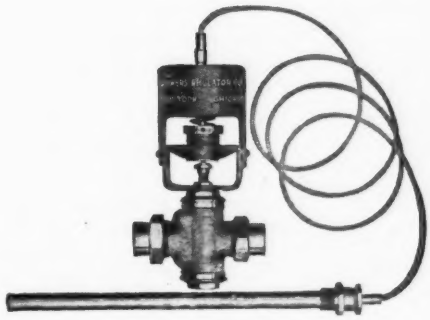
The Powers Systems

We claim for this apparatus greater beauty of design, greater efficiency, greater durability, and we give better service than can be secured elsewhere. For 25 years we have been building heat regulation as good as we know how, and thousands of pleased customers are a good indication of our success.

The Quality Justifies the Price



The Powers All Metal Diaphragm Radiator Valve



The Powers Hot Water Tank Regulator No. 11

In a class by itself because of its unequalled efficiency. We have other specialties well worthy of your attention and would like to put your name on our bulletin mailing list. A postal card will do it.

THE POWERS REGULATOR COMPANY

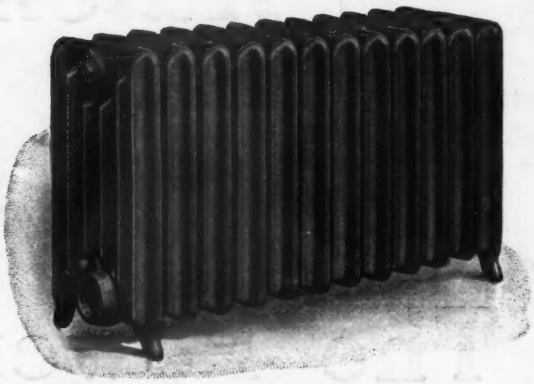
101 PARK AVENUE
NEW YORK

5 SO. WABASH AVENUE
CHICAGO

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Owners quickly approve

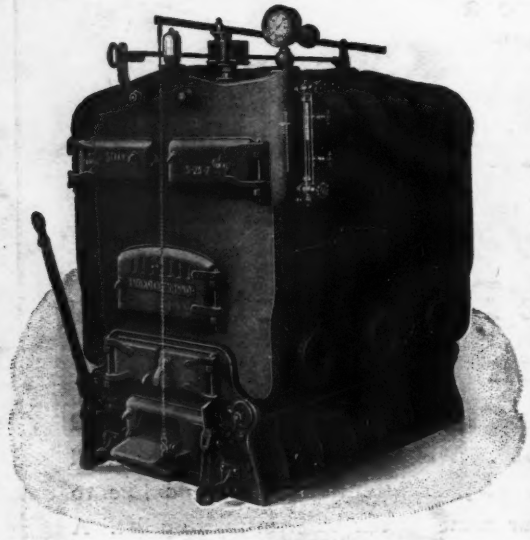
If you would have owners pay promptly you should install heating outfits that give prompt and lasting satisfaction, as do outfits of



The Popular Rococo Window Radiator

AMERICAN RADIATORS & IDEAL BOILERS

The only motive an owner has for holding up payment disappears it a competent contractor has installed the heating materials that are most favorably known.



An S-25-7 Ideal Sectional Boiler

Thus the responsibility for the goods is taken off the contractor's shoulders and assumed by the owner—the contractor has only to stand sponsor for his workmanship

Begin NOW to make collections easier by establishing a regular practice of installing these well known materials on all your work.

AMERICAN RADIATOR COMPANY

Branches in most large cities